POPULATION STRUCTURE OF PATTAPU AND PALLE:

MARINE FISHING COMMUNITIES OF SOUTH-EAST COASTAL ANDHRA PRADESH (INDIA)

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IN
PHYSICAL ANTHROPOLOGY

By
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CERTIFICATE

This is to certify that the thesis entitled "POPULATION STRUCTURE OF PATTAPU AND PALLE : MARINE FISHING COMMUNITIES OF SOUTH-EAST COASTAL ANDHRA PRADESH (INDIA)" submitted by Sri G. SRINIVASA RAO for the Degree of DOCTOR OF PHILOSOPHY in Physical Anthropology of Sri Venkateswara University, Tirupati, is a record of his research work done under my supervision and that this thesis has not been submitted for any Degree or Diploma or Associateship or Fellowship or other similar title.

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Research Supervisor

DECLARATION

I hereby declare that the thesis entitled, "POPULATION STRUCTURE OF PATTAPU AND PALLE : MARINE FISHING COMMUNITIES OF SOUTH-EAST COASTAL ANDHRA PRADESH (INDIA)", has been written by me from the investigation carried out by me. I also declare that the work is original and it has not been submitted previously in part or full to any other University for any degree, diploma or fellowship earlier.

TIRUPATI

18.1.1991

G. Srinivasa Rao

(G.SRINIVASA RAO)

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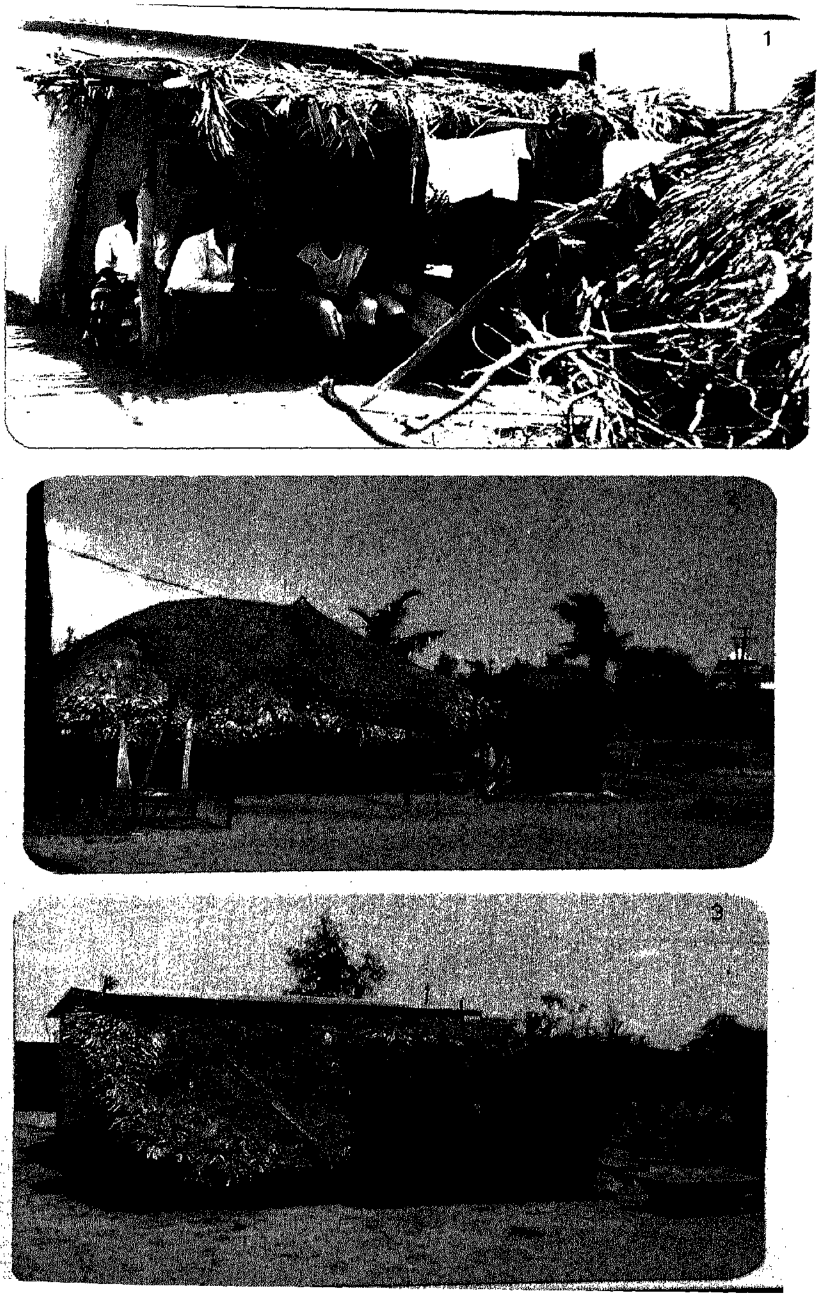

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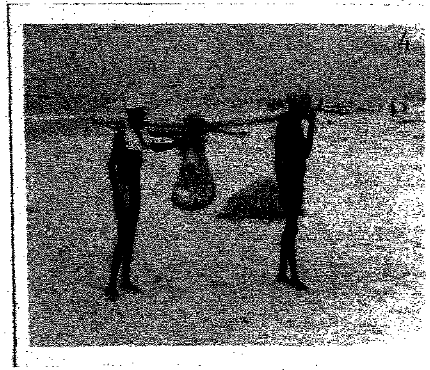

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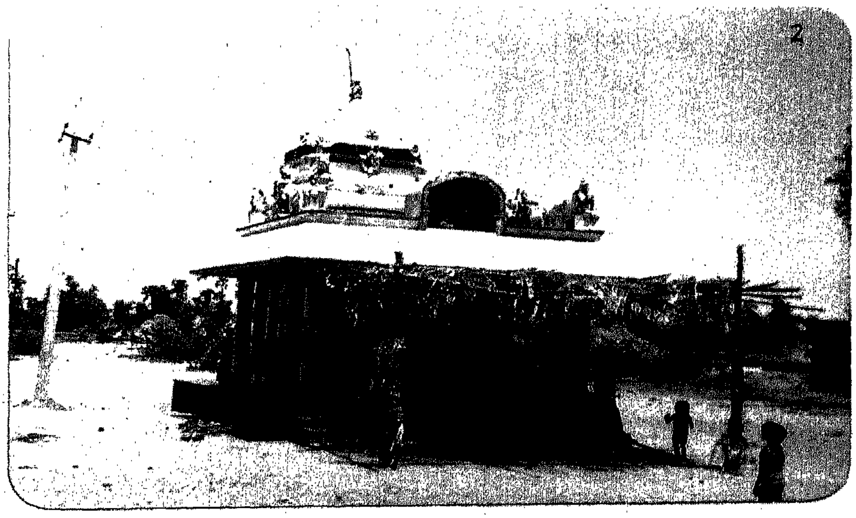
2



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DEPARTMENT OF PHYSICAL ANTHROPOLOGY, SRI VENKATESWARA UNIVERSITY, TIRUPATI

POPULATION STRUCTURE OF PATTAPU AND PALLE:

MARINE FISHING COMMUNITIES OF SOUTH-EAST COASTAL ANDHRA PRADESH (INDIA)

Investigator : G.Srinivasa Rao. Supervisor : Prof. T.Ramachandraiah.

S.No. Date: District: Village: Endogamous Group:

Husband. Name......................Surname.................. Gotra.................Age at marriage..........

Wife. Name......................Surname (Maiden) .... Gotra (Maiden) ....Age at marriage..........

Type of Family ....

S.No.	Name	Rel. to Head	Age	Sex	Marital status* M/W/D/S/UM	Level of Education	Occupation		Income	
							Main	Subsidiary	Main	Subsidiary
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

* M-Married; W-Widow/Widower; D-Divorced; S-Separated; UM-Unmarried.

Family Planning adopted : Permanent : Tubectomy, Vasectomy — Period of time:

Temporary : Pills/IUCD/MTP/IUD/Condom — Period of time:

APPENDIX-II

INFORMATION FROM WOMEN:

Age at Menarche............Marital Distance.........Age Menopause.....

REPRODUCTIVE HISTORY OF WOMEN

Preg. No.	Mothers Age	*Nature of termination	Age	If Dead		Remarks if any (Congenital Malformation)
				Cause of death	Age at	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

*L.B:- Live Born S.B: Still Born Ab: Abortion

Period of Cohabitation ______________

Disorders or Diseases if any observed Specify in Pedigree:

<u>PEDEGREE:</u>

TYPE OF MARRIAGE : Nc.M./C.M: U-Ne; FSD; MBD; 1½C: 2C; 2½C: 3C.

(Were your parents or your life parents Consanguineous : Yes/No)

CHAPTER - I

INTRODUCTION

INTRODUCTION

1.1 GENERAL INTRODUCTION

The biological evolution of human population can be clearly understood when the forces of evolution are viewed in the context of population structure of evolving populations through time. Population structure includes population size, density, age structure, growth of population, patterns of migration, breeding structure, mating behaviour of individuals etc., (Salzano, 1975). Since the process of evolution, in some form, reflects through such demographic variables, Ward and Weiss (1976) opined that "the demographic structure provides the milieu, within which the agents of genetic change can operate".

Population structure as a concept has evolved to encompass the "ensemble of factors that limit the validity of theories using random mating and infinite populations. Thus, finite population size and deviation from randomness due to geographic, demographic, ethnic, social, psychological and other factors all come into picture (Canning and Cavalli Sforza, 1973). According to wright (1951), mating systems and effective size constitute the essential components of a population structure, while Yasuda and Morton (1967) viewed the totality of deviation from Panmixia.

Natural selection can be partitioned into two components; the one due to fertility and the other due to mortality. The two can influence the genetic composition of population directly through differential survival of phenotypes on the one hand and the demographic structure of the total population on the other.

The methods of demography and genetics were successfully combined by some of the earlier workers (Roberts, 1956; Spuhler, 1959; Salzano, 1961 and 1964; Sutter, 1963; Freire-Maia and Freire-Maia, 1963; Freire-Maia and Krieger, 1963; Bonne, 1963; Neel _et al_., 1964; WHO, 1964 and 1971; Cavalli-sforza, 1967; Neel, 1968; Johnston _et al_., 1969; Reid, 1973;

and Majumdar and Malhotra, 1979) to study and understand the biological evolution of human populations.

The physical Anthropologists have also taken up studies on human populations with varied cultures inhabiting different ecological zones for a better comparison and to assess the ongoing evolutionary trends among the contemporary human populations. Of course, they use such demographic parameters like means and variance of fertility and mortality components, pattern of mating, effective population size and breeding structure and admixture rate which throw light on evolutionary processes in the respective populations.

In the broadest sense, 'Population structure' comprises the total spectrum of biological, social and demographic factors influencing the genetic make up of a population (Fix, 1982). The main aspects of population structure have been discussed in the present study about their importance in interpreting genetic variability between and within human populations. The literature pertaining to these aspects are briefly reviewed.

1.2 BIO-EVENTS

Some of the bioevents of female like age at menarche, age at marriage and age at menopause which are important

indicators to influence the reproductive performance of women, in the sense that biologically a woman with an earlier menarche/marriage and late menopause provided with higher cumulative fertility because the women start having their children at an early age and stop giving birth to children at late age. By rising the age at menarche and age at marriage and lowering the age at menopause, it is possible to cut down their effective married life and thus reduce fertility. But to increase the age at menarche and to decrease the age at menopause are biological processes and are not easy to control at a population level.

1.2.1 Age at Menarche

The age at which the first menstruation occurs among girls is referred to as age at menarche. Menarcheal age in females is considered as a measure of adolescent development. The first report on age at menarche dates back to 1895, when Robertson made an investigation of puberty of women followed by Curjel (1920). The onset of first menstruation depends upon several factors such as socio-economic level, ecological conditions, genetic background, moral, psychic environment etc., (Tanner, 1962 and Valsik et al., 1963). There are several studies (Peter et al., 1957; Bannerjee, 1972; Reddy

et al.,1974; Rao and Aruna, 1975; Sanjeeva Reddy, 1984; Singal and Sidhu, 1985; Bhaskar *et al.*,1986 and Rajangam and Thomas, 1987) on the menarcheal age among Indian women.

1.2.2 Age at Marriage

Age at marriage is the particular age at which an individual gets married. It is an important indicator to influence the reproductive performance of women. The age at marriage varies from population to population and it is affected by several factors such as education, socio-economic conditions, urbanization, religion and occupation. Generally, the age at marriage of men is greater than that of women. In India, there exists several studies on the age at marriage (Driver, 1963; Das and Benerjee, 1964; Srivastava, 1969; Agarwala, 1970; Reid, 1971; Zachariah, 1971; Veerraju, 1973; Chengal Reddy, 1979; Gunasundaramma, 1980; Balgir, 1986 and Bhaskar *et al.*,1986).

1.2.3 Age at Menopause

Menopause is generally considered as cessation of menstraul cycle, which is not a sudden process. After increased irregularity in menstrual cycle for some time,

menses stops for ever. Menopause usually becomes manifested between 40 and 50 years of age, which depends on individuals health, economic status, climatic factors and hereditary background of the individual. The influence of nutrition on menopausal age is that better economic conditions and good food delay the age at menopause (McMohan and Worcester, 1966). There are few studies (Gunasundaramma, 1980; Subhashini, 1985; Singal and Sidhu, 1985; Manjuvani, 1987 and Rajangam and Thomas, 1987) on the menopausal age among Andhra Pradesh women.

1.3 MATING PATTERN

The patternof mating is one determinant of how genes are combined in genotypes in human and other bisexual populations. Given the gene frequencies for a generation and knowledge of the pattern of mating, one can in principle predict the distribution of genotypes for that generation. Thus, different patterns of mating may have different behavioural consequences in a breeding population to the extent that differential behaviour is in some part, a result of differences in genotypes. Biological, demographic, social and cultural factors inter-play their role leading to differential patterns of mating in human populations (Ford,

1945 and Lorimer, 1954) and these influence the structure of population (Leslie et al., 1978 and Sussane, 1979). It is important to know the preferential mating pattern and marriage practices existing in Indian populations, as these factors play a major role in the consanguinity determination. In human societies, mating between individuals associated with the social institutions of marriage and consanguineous marriages to a greater extent are the manifestation of cultural behaviour of mating groups (Reid, 1973)

Inbreeding is a genetic consequence of consanguineous mating which occur between genetically related persons with at least one common ancestor. Inbreeding is one among the parameters of population structure, which is determined not only by physical but also by cultural and socio-economic factors of the population.

The quantitative treatment of inbreeding has been formulated fundamentally by two approaches. Wright (1921 & 1922) treated it as a correlation between mating gametes as a result of assortative mating from any cause, which later contributed to the works of genetics of sub-divided populations (Wahlund, 1928; Wright, 1931 and Yasuda and Morton, 1968) and on isolation by distance (Wright, 1943).

Malecot (1948) treated it as the probability of homologous genes of uniting gametes being identical by descent from one or more common ancestors. These two approaches yield one and the same coefficient when one considers an infinite population or a particular type of consanguineous mating, but differ in finite and subdivided populations. Among finite populations Wright's Coefficient will be zero in the first generation offspring of a random mating population. While the Malecot's coefficient after an initial generation is $\frac{1}{2}$ N and thereafter increase to

$$F_t = F_t-1 + (1-2\ F_{t-1} + F_{t-2})\ /\ 2\ N$$

after t generations (Crow and Kimura, 1970). In case of sub-divided populations the two approaches yield similar coefficient value if the differences among the sub-populations are entirely due to drift.

1.3.1 Consanguinity and Inbreeding Level

The observed level of inbreeding in no human population is greater than 5 per cent and most populations have a coefficient below 0.01 (Cavalli Sforza and Bodmer, 1971 and McCullough and O'Rourke, 1986). Only some local populations of Brazil, Japan, India, Ceylon and Israel, which encourage consanguineous marriages have been noted for the

higher rates of inbreeding (Dronamraju and Meerakhan, 1963a; Sanghvi, 1966; Freire-Maia, 1968 and Reid, 1973 and 1976). Populations of America, Canada, Europe have been generally found with lower rates of inbreeding. Among Americans, the coefficients have been found in the range of 0.00009 - 0.00119, in Latin Americans in the range of 0.0003 - 0.003, which is "12 to 25 times greater than the American ones and 2 to 3 times higher than the Canadian one" (Freire-Maia, 1968). For Japanese, the values of F are noted to be in the range of 0.002 - 0.013 except those of isolates, which are found to have a range of 0.007 - 0.018 (Komai, 1972).

In contrast to the western countries and compared to Northern India, the prevalance of high inbreeding rate was reported from Southern India, particularly from the State of Andhra Pradesh (Dronamraju, 1963; Sanghvi, 1966, Veerraju, 1971, 1973 and 1978; Mukherjee et al., 1974 and Roychoudary, 1976) followed by Maharashtra (Sanghvi, 1954 and Sanghvi et al., 1956), Tamilnadu (Chakravarthi, 1968; Centerwall et al., 1969 and Rao, 1978), Kerala (Kumar et al., 1967 and Ali, 1968). Unlike in North India, where the inbreeding rates were low (Delhi and Lucknow: Basu, 1978; West Bengal: Huq, 1976 and Madhya Pradesh: Goswami, 1970).

In Southern Part of India few studies show low inbreeding values due to economic and social/psychological backgrounds (Dronamraju and Meerakhan, 1963; Centerwall and Centerwall, 1966; Reid, 1971 and Govinda Reddy, 1981).

1.3.2 Factors influencing consanguineous marriages

There are many factors to influence the prevalence of consanguineous marriages (Ichiba, 1953; Schull, 1958; Dronamraju, 1964; Sanghvi, 1966; Centerwall and Centerwall, 1966; Freire-Maia, 1967; Komai, 1972; Reid, 1973; Ramesh, 1979 and Govinda Reddy, 1981). In an extensive survey, Rao and Inbaraj (1977a and b) analysed the socio-economic and demographic variables influencing inbreeding. Malhotra (1976) studied the impact of two different cultures (Indo-Aryan and Dravidian) on inbreeding and consanguinity in a semi-nomadic caste-cluster, Dhangers who are distributed throughout the Maharashtra State.

1.3.3 Temporal trend of Consanguineous marriages

In Indian populations over the past few decades there has been a little gradual decrease in the frequency of Consanguineous marriages (Sanghvi *et al*.,1956; Dronamraju

and Meerakhan, 1963a; Rao *et al*., 1971; Srinivasan and Mukherjee, 1976; Mukherjee *et al*., 1977; Chengal Reddy, 1983a; Yaseen Saheb, 1983 and Papa Rao, 1989) like outside India, where it shows a significant decline in the incidence of consanguinity (Polman, 1951; Daraemaeker, 1958; Sutter and Goux, 1962; Salzano and Freire-Maia, 1970; Imaizumi *et al*., 1975 Blanco and Chakraborthy, 1975; Lazo *et al*., 1978 and Imaizumi, 1986). But in the study of Rao and Inbaraj (1977), such trend was not observed.

1.4 MATRIMONIAL DISTANCE (OR) MARITAL DISTANCE

Genetical structure of a local population is determined by the amount of gene flow and the size of the geographical area over which the genes are flowing, which arise from marital movement. It can be derived from the distance between the birth places of spouses. Migration and other forms like marital movements influence the integrity of the human species in its wide range. So, marital distance is one of the important measures of the population structure.

In recent decades, a number of the theoritical models have been developed to measure the spatial distribution of genes (Cavalli-Sforza, 1958 and 1962; Boyce *et al*., 1967;

Malhotra and Majumdar, 1974; Chopra, 1974; Malhotra and Kanhare, 1975 and Majumdar, 1977).

There is a slight variation in the usage of the concept of marital distance. Coleman (1977) defined it as the distance between the places of residence at the time of the marriage of the spouses and the birth place distance as the distance between birth places of spouses. In the present study, marital distance was taken as the distance between the birth places of spouses.

Marital distance is affected by many environmental factors, communication facilities and social factors including the social class of an individual (Kuchemann et al., 1974) Data on the genetic structure of Indian populations are inadequate to understand its genetic diversity at sub-population level. Indian marriage patterns are mostly governed by the caste system, besides diverse ethnic, religious and linguistic differences as a result of which marital distance is limited to small neighbourhood populations (Majumdar, 1977 and Malhotra, 1978a and 1978b).

Marital distance and the frequency of consanguineous marriages in populations gave a good estimate to understand

the population structure (Cavalli Sforza, 1958, 1962; Boyce et al., 1967 and Malhotra and Majumdar, 1974). It has been observed that the frequency of consanguineous marriages decreases with an increase in marital distance (Freire-Maia and Freire-Maia, 1963; Salzano and Freire-Maia, 1970; Malecot, 1967; Mukherjee et al., 1977; Malhotra, 1978; Majumdar and Malhotra, 1979; Ramesh, 1979; Govinda Reddy, 1981; Chengal Reddy, 1983b; and Mohan Reddy, 1983).

1.5 DIFFERENTIAL HUMAN REPRODUCTION

Since a wide and significant variation in mean live births and pre-reproductive mortality was observed among the populations, an attempt was made to ascertain if this variation can be explained with the help of the variation in the measures of population structure found among them.

1.5.1 DIFFERENTIAL FERTILITY

Fertility, "refers to the actual reproductive performance-whether applied to an individual or a group (Freedman, 1963). The study of human fertility occupies a central position in the study of population for several reasons. Human fertility is responsible for biological replacement and for the maintenance of the human society.

Any society replenishes itself through the process of human fertility. Thus, in population dynamics, fertility is a positive force through which the population expands, counteracting the force of attrition caused by mortality. The process of replacement of a group through fertility is a complicated process. With in the biological limits of human fertility, several factors are responsible for determining the levels and differentials of fertility.

1.5.1.1 Duration of effective married life

To study the fertility differentials, duration of effective married life is a more important parameter than Age at menarche and women's age at marriage, because few women get married immediately after attaining menarche. In the same way, among widows, Family Planning adoption cases and divorces, the age at marriage of women may not have expected influence on fertility. Fertility studies show a positive relationship with duration of effective married life (Susmita Talukdar, 1978; Gunasundaramma, 1980 and Papa Rao, 1989).

1.5.1.2 Economic level and Fertility

General studies in the past have highlighted the inverse relationship between the economic status of the family

and fertility (Bhende and Kanitkar, 1978). This traditional relationship is now undergoing substantial changes as far as the developed countries are concerned. Freedman (1963) explained the reasons for conventional inverse relationships between economic status and fertility. Children are an economic burden impeding social mobility for high income groups. Another reason may be less familistic orientation of the economically advantaged classes because of other cultural interests probably resulting from their better education. Hill _et al_., (1955) reported only an indirect relation between social status and fertility in Puerto Rico. Vostrikova showed lower fertility for medium and higher income groups than among low income groups.

In India, very few studies have been made to see the relationship between the income of the family and fertility. Out of these, most of the studies showed no definite relationship of economic status and fertility (Mahalanobis, 1955; Agarwala, 1970 and Gunasundaramma, 1980). But Driver (1963) reported the indirect effect of economic status on fertility in Central India.

1.5.1.3 Consanguinity and Fertility

The effects of inbreeding on fertility are generally assessed by empirical comparison of various attributes of

fertility among consanguineous and non-consanguineous couples. The effect of consanguinity on fertility have been found to vary from population to population and may also depend on socio-economic, demographic and behavioural factors.

Elevated fertility rates among consanguineous couples than in non-consanguineous couples are found in population studies of United States (Darwin, 1871; Huth, 1875 and 1879; Pearson *et al*., 1899; Pearson, 1902; Fisher, 1949 and Eaton and Mayer, 1954), Europe (Darwin, 1875; Book, 1957 and Darlington, 1960), South America (Freire-Maia and Krieger, 1963 and Freire-Maia and Azevedo, 1971), Japan (Schull *et al*., 1970a; Schull and Neel, 1972; and Schull, 1973), Egyptian Nubia (Hussien, 1971), French Canadian populations (Philippe, 1974 and Laberge, 1967), India (Reid, 1973; Basu, 1978; Puri *et al*.,1978; Rami Reddy and Papa Rao, 1978; Yaseen Saheb *et al*.,1978; Rao and Inbaraj, 1979a and b; Ramesh, 1979; Govinda Reddy, 1981, 1986 and 1987; Chengal Reddy, 1983a; Mohan Reddy 1983 and Sirajuddin and Basu, 1984). Lowered fertility among consanguineous couples as opposed to the elevated levels in non-consanguineous couples have been noted in Italy (Conterio, 1969), Brazil (Marcallo *et al*., 1964; Freira-Maia and Krieger, 1975), Sri Lanka (Reid, 1976),

French (Georges and Jacquard, 1968), Europe (Sutter and Tabah, 1953) and India (Rao and Inbaraj, 1977a and Ansari and Sinha, 1978).

However, a few studies in United States (Arner, 1908; Slatis et al.,1958), Europe (Uchermann, 1907; Sutter and Tabah, 1952, 1955 and 1958), Jordon (Cook and Hanslip, 1966), Kurdistan (Goldschmidt et al., 1963) and India (Radha Ramadevi et al.,1982) have shown that there is no difference in fertility levels among consanguineous and non-consanguineous couples.

1.5.1.4 Family Planning Adoption and Fertility

As a social practice, family planning is an age old one in the sense that knowledge of contraceptives, in some form or the other has existed for centuries. The term family planning is used deliberately as birth control including contraception, sterilization, abortion and infanticide. According to WHO Expert Committee (1971) it is "a way of thinking and living that is adopted voluntarily, upon the basis of knowledge, attitudes and responsible decisions by individuals and couples, in order to promote the health and welfare of the family group and thus contribute effectively to the social development of a country". Family Planning

is influenced by various aspects of the cultural environment (technology, economy, social structure, values and ideologies etc.). Several scholars from India and abroad made an attempt to develop theories/models on family planning and fertility behaviour (Dandekar, 1959; Driver, 1963; Chandrasekhar, 1972; Mamani, 1972; Hwan-sang et al.,1973; Rele and Kanitakar, 1980; and Gunasundaramma, 1982).

Michielutte et al.,(1973) stated that the adoption of family planning in a society is a function of the modernisation process. The introduction of family planning programmes can have a substantial independent impact on fertility (Berelson, 1963; Bogue, 1967; Freedman and Takeshita, 1969; and Kirk, 1969). Recent studies (Bogue and Tsui, 1979a and 1979b; Demery, 1979a and 1979b; Dixon, 1978; Kirk, 1979; Mauldin and Berelson, 1978a and 1978b; and Tsui and Bogue, 1978) that encompass the effect of family planning programmes on developing world fertility. In the developing countries, the interest in family planning is reported to be positively correlated with education.

1.5.2 DIFFERENTIAL MORTALITY

Historically, mortality has played a dominant role in determining the growth of population, the size of which

fluctuated in the past mainly in response to variation in mortality. The study of mortality deals with the effects of death on population. The United Nations and World Health Organisations (1962) have defined death as follows: "Death is the permanent dis-appearance of all evidence of life at any time after birth has taken place (Post-natal cessation of vital functions without capacity of resuscitation)". The study of mortality is useful for analysing current demographic conditions as well as for determining the prospects of potential changes in mortality conditions of the future.

Obviously, in studying the relationship between mortality and biological and genetical factors (inbreeding) different functional relationships may be used.

1.5.2.1 Biological factors and Mortality

A considerable proportion of neonatal, post-neonatal and childhood deaths arise in conjunction with the characteristics not only of a child but also of the mother such as mother's age at the time of delivery, birth order (Mittal and Ketker, 1970). In recent time growing interest in the

study on the effect of birth order and mother's age on reproductive wastage has been observed among the human biologists.

1.5.2.1.1 Mother's age at the time of Delivery

Mother's age at child birth is an important determinant of prenatal and post natal mortality. Quite a number of studies conducted in different parts of the world revealed the influence of this variable in the health and survivorship of children (Heady, et al., 1955; Stoeckel and Chowdhury, 1972; WHO, 1976; Meegama, 1980). Further, the probability of succumbing to mortality early in life has been shown to be associated with the age of the mother at the birth of the child (Taussing, 1931 and 1936; Pearl, 1939; Stradskov and Einhorn, 1948; Schreider, 1967; Chandrasekhar, 1972; Nortman, 1974; Bouvier and Vander Tak, 1976; Balakrishnan, 1978; Omran and Standley, 1981 Cochrane and Zacharaiah, 1983 and Rutstein, 1983).

1.5.2.1.2 Birth order and Mortality

Birth order is generally an important factor to correlate with mortality parameters. It is well known that several

studies on mortality conducted in different parts of the world showed a 'U' or shallow U or a reverse 'J' shaped curve in relation to birth order (Taussing, 1931 and 1936; Yerushalmy, 1938; Pearl, 1939; Wyon and Gordon, 1962; Newcombe, 1965; Stoeckel and Chowdhury, 1972; Podder, 1975; WHO, 1976; Meegama, 1980; Palloni, 1981 and Mahadevan et al.,1985).

An association between birth order and mortality is expected, of course, since birth order and age of mother are correlated. The first baby is usually born when the mother is young and the higher order births take place when the mother is relatively old (Badari et al., 1979).

The incidence of mortality during the higher parities according to Bhattacharya et al., (1980) is due to the negative value attached to female children. The Kenya Fertility Survey (KFS) reported that infant mortality rates for males are higher than for females. This is consistant with evidence from other studies (Naeye et al., 1977; Somoza, 1980 and Mahadevan et al., 1981).

1.5.2.2 Consanguinity and Mortality

Studies on the correlation of inbreeding with negative attributes of reproduction which include abortions, mis-

carriages, stillbirths, infant and Juvenile mortality are generally empirical as our knowledge about the role of genes in causing mortality is inadequate (Sanghvi, 1966). Various types of mortality among consanguineous and non-consanguineous couples of several populations from almost all parts of the world have been studied for inbreeding effect on mortality.

Most of the studies on the effects of parental consanguinity and inbreeding on mortality revealed elevated levels (from slight to moderate) of pre-reproductive mortality among the offspring of consanguineous couples (In U.S population: Bemiss, 1858; Arner, 1908; Slatis _et al_., 1958; in Japanese populations: Neel and Schull, 1962; Schull and Neel, 1965; Schull _et al_. 1970b; Yamaguchi _et al_., 1970; Tanaka, 1973; in Brazillian populations : Salzano _et al_., 1962; Freire-Maia and Krienger, 1963; Marcallo _et al_., 1964; Egyptian populations: Hussien, 1971; in Czechoslovakia: Seemanova, 1971; in Italy : Serro and Soini, 1963; Centerio, 1969; in Sweeden: Book, 1957; in France : Sutter _et al_., 1953; and in Indian populations : Kumar _et al_., 1967; Reid, 1971; Murthy and Jamil, 1972; Basu, 1975; Rao and Inbaraj, 1977; Rami Reddy and Naidu, 1978; Puri _et al_., 1978 Ramesh, 1979; Narahari, 1982; Chengal Reddy, 1983a; Sira-

juddin and Basu, 1984; Govinda Reddy, 1985 and 1986; Srinivasa Rao and Ramachandraiah, 1986; Chandra Sekhar, 1989 and Papa Rao, 1989). Lowered mortality in the off-spring of consanguineous couples as opposed to an elevated level in non-consanguineous couples has been noted in Tanner (1958) studies. But in some studies (Cook and Hanslip, 1966; Roberts and Bonne, 1973; and Reid, 1976) influence of consanguinity on mortality was not found.

1.5.3 SELECTION INTENSITY

Natural selection, through fertility and mortality plays an important role in the evolution of population. Differential mortality and fertility, if in part due to genetic differences between individuals, will result in a change in the gene Pool from one generation to the next. When the successful genotypes come to make up a great portion in a given environment than that of individuals of an alternative genotypes, it implies Natural Selection. Selection is operative when individual members of the population contribute disproportionately to the next generation (Neel, 1958). The extent to which natural selection can operate in a population is measured by the index of total selection (Crow, 1958) or the index of opportunity of selection (Crow, 1966).

There were differences in mortality among different parts of the country and also differences in fertility (Hofsten and Lundstrom, 1976), even though these might be more distinct between social classes than between regions. Intra-population selection in Fizi has been well documented by Roberts and Mohan (1976), involving the replacement of native by the alien immigrant population, at least during the initial stage through the differential fertility and mortality. In caste populations some studies showed lower mortality component than fertility component (Mukherjee, 1974; Chengal Reddy and Lakshmanudu, 1979; Gunasundaramma, 1980 and Hed, 1986) and few studies showed higher mortality component than fertility component (Subhashini, 1981; Sankaraiah, 1983; Mohan Reddy, 1983; Rajasekhar Reddy, 1984; and Chandrasekhar Reddy, 1984) which is expected in most of tribal populations (Spuhler, 1962; Ramachandra Reddy, 1984; Deepkumar, 1985 and Ramesh and Murthy, 1985). Family Planning adoption may play a major role on selection intensity (Ramachandra Reddy, 1984).

1.5.4 EFFECTIVE POPULATION SIZE

Effective population size is an important parameter of population structure, and it is defined as the number of individuals who really contribute to genetic composition

of the next generation. The smaller the effective size the higher the possibility of drift effects in a population. Following the suggestions of Salzano et al., (1967), Swedlund (1971), Freire-Maia (1974) and Sheets (1980, effective population size can be precisely calculated using Wright's (1938, 1940) formula.

Nearly one third of the Census size (Chopra, 1974) of a population is considered as effective size and this is generally smaller than the breeding size, because the variance of the mean number of gametes per person to the following generation in general larger than the mean. The factors which influence the effective size are the number of individuals in the reproductive age, differential fertility, distorted sex ratio and high inbreeding rate (Freire-Maia, 1974). In the presence of related individuals (Salzano, et al., 1967) and heritability of fertility (Nie and Murata, 1966 and Cavalli-Sforza and Bodmer, 1971), the effective size tend to be smaller than breeding size.

1.6 EARLIER WORKS ON THE MARINE FISHING COMMUNITIES

Fishing, like hunting and gathering is an ancient occupation. Fishermen thus constitute an important part of

Indian peasantry supplying fish protein. A large number of endogamous groups of marine fishermen live along the 3000 mile long coast of India. They numbered about 9,67,880 individuals constituting about 0.3% of the total population (Hutton, 1931). Socio-economically they are comparable to any tribal or economically backward community of India.

Except for a recently concluded work on reproductive structure and mating patterns of fishermen in Kolleru lake (Mohan Reddy, 1983; Mohan Reddy et al., 1987 and Mohan Reddy and Malhotra, 1988), and few scattered reports on socio-economic aspects of marine fishermen (Thurston, 1909; Sanghvi, 1966; Mukherjee, 1968 and 1970; Lal, 1970, Razaaq, 1970; Veerraju, 1973; Suryanarayana, 1977, Roychoudhury, 1980; Munirathnam Reddy, 1987 and Mahendra Reddy, 1989), they are relatively unfamiliar to Indian Anthropology. A few works on genetic demography (Rami Reddy and Papa Rao, 1978; Mohan Reddy, 1981 and 1983 and Mohan Reddy et al., 1986 and 1987) are initiative rather than extensive, and much of the marine fishing community groups are uncovered for physical Anthropological studies, and the inevitability to fill the lacunae was felt to be imminent in order to understand the structure of the population. In addition to this, the studies with reference to demographic variables among two populations of

same ecological zone i.e., marine fishing zone are either meagre or absent from India to the best of the author's knowledge. Also studies pertaining to the effects of demogenetic factors on mortality have not been extended to the level of sex. All these made us to take interest in studying the two populations, namely Pattapu and Palle which are inhabiting the marine fishing zone, i.e., coastal zone of Nellore district, Andhra Pradesh.

1.7 AIMS AND OBJECTIVES OF THE PRESENT STUDY

1.7.1 The aims of present study

In the light of above it was aimed to evaluate demo-genetical similarity or diversity between the two Marine fishing groups-Pattapu and Palle of a similar rank inhabiting the same region, for different demo-genetical parameters of population structure. For this purpose, the Pattapu and Palle marine fishing communities from Nellore district, where they are more or less equally concentrated, have been selected for the present study.

1.7.2 Objectives of the present study

The following are the objectives of the present study:

1. To find out the basic components of population compo-

sition i.e., age and sex distribution and marital status among the Pattapu and Palle.

2. To have a comparative account of various demographic aspects such as age at menarche, marriage and marriage types as well as marital distance and menopausal age of the said populations.

3. To elucidate the information on breeding structure of the population, and to examine the spatial and temporal variation in consanguinity and inbreeding;

4. To assess the relative roles of fertility and mortality differentials in the opportunity of selection potential and

5. To evaluate the effect of selected demo-genetic factors on fertility and mortality (foetal deaths, neonatal, post-neonatal deaths, infant deaths and childhood deaths) among Pattapu and Palle.

CHAPTER - II

PROFILE OF AREA AND THE PEOPLE

2.1. ENVIRONMENTAL SET UP

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2.1.2. General features of the area under study.

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PROFILE OF AREA AND THE PEOPLE

In this chapter, an attempt has been made to describe the environmental set up of the study area and an ethnographic profile of the populations under study.

2.1 ENVIRONMENTAL SET UP

2.1.1 Geographical features of the State of Andhra Pradesh

The state of Andhra Pradesh, where the field area, i.e., Nellore district of the present study is situated, is the fifth largest in area and fourth most populous state of India, sprawls across a greater part of Deccan Plateau, sloping down to embrace the quiet water of the

Bay of Bengal. The state is spread over an area of 2.76 lakh sq. km. with over 5.35 crore (census, 1981) people living in 23 districts of the state.

The state lies between the latitudes $12^{\circ}4'$ N and $19^{\circ}54'$ N and the longitudes $76^{\circ}50'$ E and $84^{\circ}54'$ E. It is geographically bounded on the north by Orissa and Madhya Pradesh, on the north-west Maharashtra, on the west by Karnataka, on the south by Tamilnadu and on the eastern side by a long coastal line of the Bay of Bengal, running nearly 974 kms. Owing to its geographical position, the state forms a major link between Northern and Southern states.

The state is geographically divided into three regions Coastal plains, eastern ghats and the western peneplains. While the coastal plain comprise the 974 km. long coast from North to South, the eastern ghats are a series of broken hills and there is not much vegetation. The area covering Kurnool and Anantapur districts and the whole of Telangana is called the western peneplains.

Politically and culturally, the state is divided into three regions - coastal Andhra Pradesh, Rayalaseema and

Telangana. A gradation of differences between each of these regions can be perceived in dialect, life ways and cultural factors. Politically these regions were under the rule of three different dynasties in the past and the cultural heritage signifies the historical patronage of the past.

The state is aptly called the riverine state. Most of the rivers are rainfed and they flow east ward from the western ghats to the Bay of Bengal. The Godavari and Krishna are the largest rivers flowing through the heart of the state. They are perennial and are responsible for the formation of fertile tracts in the deltas of the districts of Krishna and Godavari. Apart from these, there are many medium sized rivers like the Vamsadhara, the Nagavalli, the Penna, the Kadam, the Musi, the Manjira and a large number of minor rivers.

There is a regional variation in soil fertility. The fertile delta areas in the coastal districts are the result of alluvial soil and silt deposited by the rivers Godavari, Krishna and Pennar. The rich black-cotton soil, which has a high moisture retaining capacity covers a major portion of many districts including the non-deltaic areas and

coastal and Rayalaseema regions. Superior and inferior red soils are also found in other parts of Rayalaseema region. The Telangana region has mostly rugged and heavy undulating topography.

2.1.2 General features of the area under study

Nellore is one of the leading marine districts in Andhra Pradesh with a sizeable part of its population depending on fishing for its livelihood. Nellore district has 13.7 per cent of marine fishing villages, 7.4 per cent of marine fishermen families and 6.6 per cent of marine fishermen population in Andhra Pradesh. The coastal line of the district running to about 163 Km. is quite rich in marine fishery resources. It is the southern most coastal district of Andhra Pradesh extending over an area of 13,076 sq. km. It is lying between $13^{o}-30'$ and $15^{o}-51'$ of Northern latitude and $70^{o}-5'$ and $80^{o}-16'$ of the eastern longitude. It is bounded on the North by the Prakasam district, on the East by the Bay of Bengal, on the south by Chittoor district of Andhra Pradesh, on the South-West by Chengalpat of Tamilnadu and on the West by Veligonda hills which separate it, from Cuddapah district.

There are three revenue divisions with head quarters at Kavali, Nellore and Gudur with 18, 12 and 16 mandals

respectively. The population of the district is 16,09,617 (1981 census) and over 79.3 per cent of it constitutes the rural population. Literacy of the district is 32.16 per cent of which it is 41.03 per cent in males and 23.09 per cent in females.

The geographic, climatic condition of the study area is almost similar to that of the other areas of the district.

2.1.2.1 **Temperature**

May is the hottest month in the district with maximum mean temperature of 30.60°C and the minimum mean temperature of as 20°C recorded during January. Both the maximum and minimum temperatures steadily rise from January to May and show downward trend in the remaining months upto December.

2.1.2.2 **Humidity**

The normal humidity is high in the district in the months of November, December and January ranging from 84 to 64 per cent. It is lowest in the month of June ranging from 57 to 46 per cent.

2.1.2.3 Rainfall

Normal rainfall of the district is 1041 mm, which is more than the state's average of 141 mm. Major portion of the rainfall is received during North-East monsoon i.e. from October to December only. This district is prone to cyclones during the North East monsoon period.

2.1.2.4 Rivers

The main sources of irrigation in the district are rivers namely Pennar, Kandleru and Swarnamukhi drain, traversing through the district from West to East and flowing into the Bay of Bengal. These three rivers are not perennial and get dried up during the major period of the year.

2.1.2.5 Agriculture

The food and commercial crops cultivated in this district are paddy, jowar, bajra, chillies, groundnut and tobacco. Total cropped area in the district is 9,05,080 acres of which paddy constitutes 57.37 per cent, jowar 7.89 per cent and groundnut 12.85 per cent.

2.2 MARINE FISHERMEN

A large number of endogamous groups of marine fishermen live along the 5,650 kms. long coast of India. Fishing is the main and perhaps the only occupation of an estimated 5.38 million people of India (centre for science and Environment, 1985). Marine fishermen called by different names like Pattapu, Palle, Jalari and Vadabalija are distributed along the 964 km. coast line of Andhra Pradesh. In Nellore district the marine fishermen, such as Pattapu and Palle, were selected for the present study.

2.3 A BRIEF ETHNOGRAPHIC ACCOUNT OF THE PATTAPU AND PALLE

2.3.1 General information

Thurston's "Castes and Tribes of Southern India" (1909) provides some information on the fisherfolk of Andhra Pradesh. In his book he has given a brief note on the Pattapu, which explained about their migration from Tamilnadu. Pattapu is a name for Tamil Pattanavans, who have migrated to the Telugu country. The word Pattapu has been derived from the word Pattanavan, which explains that once they were residing at Pattanams (towns) on the sea coast, eg., Nagapattanam (Nagapatnam), Chennapattanam (Madras).

Concerning the origin of the caste, there is a legend that the Pattanavans were giving silk thread to Siva and were hence called Pattanaval, a corruption of Pattanaivor, meaning knitters of silk thread. They were at the time all bachelors, and siva suggested the following method of securing wives for them. They were told to go out fishing in the sea, and make of their catch as many heaps as there were bachelors. Each of them then stood before a heap, and called for a wife, who were created there from.

According to another story, which explained the origin and adoption of fishing occupation, some five thousand years ago, during the age of the lunar race, there was one Dasa Raja, who was ruling near Hastinapura, and was childless. To secure offspring, he prayed to God, and did severe penance. In answer to his prayer, God pointed out a tank full of lotus flowers, and told the king to go thither, and call for children. Thereon, five thousand children issued forth from the flowers, to the eldest of whom the king bequeathed his kingdom, and to the others money in abundance. Those who received the money travelled southward in ships, which were wrecked, and they were cast ashore. This compelled them to make friends of local sea fishermen, whose profession later they adopted.

Another story explains their migration to Telugu country and change the name Pattanavans to Pattapu. Once they were residing in towns. One day the king of that area visited the Pattanavans area and saw a daughter of Pattanavans Kula pedda (Head man) and sought to marry her. According to their tradition they were not allowed to marry persons from other castes. Tradition being a potent force they could not concede the request of the king. Irked by the refusal the angry king threatened that "if you are not agreed for this marriage, I will smash your caste". Even then, they did not agree to give. Subsequently, for their own safety they secretly migrated to different areas from that kingdom. Voyaging over the sea they managed to reach other places in safety. In course of time their name Pattanvans was modified to Pattapu in Telugu country. During the period of migration and before their settlement, they depended upon the sea for food by fishing and hence became marine fishermen.

In the case of the Palle, the people call themselves as Agnikula Kshatriyas, as they are the descendants of Agni the God of Fire. They are also known as Palle Kariyalu, Pallekaru and Palle Kapu. Regarding their origin a claim is made that they are the progeny of the mythical Santhanava

and Bheeshma of Vyasa's Mahabharat. Beyong this nothing is known of the history and origin of this Palle group of marine fishermen.

Both Pattapu and Palle are included under socially and economically backward community list by the Government of Andhra Pradesh. Both the populations speak Telugu. However, the Pattapu have their own dialect-pattapu Basha, which is an admixture language of Tamil and Telugu.

2.3.2 Food and Food habits

The food habits of the fisher folk are to some extent similar to those of the other castes in Andhra Pradesh. The staple food for the fisherfolk is rice followed by Ragi, locally called Chodi. Ragi is taken as food by means of Sankati (Ragi balls) among the Palles but with the Pattapu it is taken as a Java or Ambali (gruel). The principal curry they prepare is from fish. The other non-vegetarian dishes they prepare are from meat and eggs. They do not eat beef. Pork is eaten only by a few people of the Pattapu but Palles do not take it. Along with gruel some times they eat dry fish roasted in fire. They consume all varieties of pulses. Alcholic drinks are available in all the fisherfolk villages. Soon after returning from the

fishing expedition, many people go for the liquor shops, while their wives engage themselves in selling fish. Their women also take alcoholic drinks during the festive and ceremonial occasions.

2.3.3 Physical Features

The Pattapu and Palle are generally medium in stature and some of them show tall frames. The skin colour is dark or medium brown in both males and females. However, they are feeble in body build because of low economic status and malnutrition. The eye colour is brown among them. Their hair is coarse, straight and black or dark brown, and some of them have curly and short hair. They are unattractive in their complexions on account of their continuous occupational strain and constant child birth make their old women dull. In all these features both Pattapu and Palle show a similarity. Comparatively it is the Pattapu folk who are more rough in their physical appearance than the Palles.

2.3.4 Habitation

Both Pattapus and Palles tend to inhabited in villages exclusively of their own caste people. The villages are

usually named after the name of the caste, as for instance, Pattapu palem for Pattapus and Palle palem for Palles. Houses are raised over wooden poles with a thatched roof and mud walls and floors. Recently in some villages Government constructed the colonies for their residence.

2.3.5 Social structure

Both Pattapu and Palle have no sub divisions. The Pattapu and Palle belong to Gobbi and Ravikula gotras respectively. But both are endogamous in nature. It suggests that gotra system is not traditional for the fisherfolk. They might have borrowed the concept of gotra from the higher castes by completely changing the basic feature of the term. Apart from gotras they have inteperulu (Surnames), which govern the marital relations. Generally, the families who have the same surname are siblings or the nearest blood relatives.

→Caste←	Endogamy →←
→Gotra←	Exogamy ←→
←Surname→	

Surname groups live on strong patrilineal basis by which the female after marriage assumes the surname of her husband. Each surname group is made up of a number of families.

In the traditional four-tier varna system of Hindu, the Pattapu and the Palle come under the sudras which comprise large number of castes. Among sudras, they enjoy the same social status as that of the artisan and service castes viz., the Kummaris (Potters), the Chakalis (Washerman), the Mangalis (Barbers) etc. The Pattapu are said to be inferior to the Palles who will not accept food at their hands, and discard even an earthen pot which has been touched by a Pattapu. However, among themselves each of them claim superior status over the other.

2.3.6 Institution of marriage

The exogamous septs (intiperulu or surnames) govern their matrimonial alliances in both Pattapu and Palle castes. Marriage between the members of the same surname groups is strictly prohibited. They practise the consanguineous marriages (menarikam customs). They marry their elder sister's daughter, maternal uncle's daughter and paternal aunt's daughter. Marriage between parallel cousins is not allowed.

The pre-puberty marriage once in practice, is no more in vogue today and their girls now-a-days are married after attaining puberty. The age at marriage varies from 13 to 18 years for girls and from 19 to 23 years for boys. Marriage

by negotiation (Peddala nirnayam) is common. Monogamy is the present norm of the society. Dowry exists in the form of cash or kind. Residence after the marriage is patrilocal. Widow remarriages are strictly prohibited. Divorce is permitted with the consent of Kulapanchayat (Caste council) and after divorce only men are allowed to marry again (polygyny).

2.3.7 Family

Family among the Pattapu and Palle is of the nuclear type. It is characterised by Patrilocal residence, patrilineal descent and patriarchal authority. Joint families exist with negligible frequency and more over they are also breaking up due to lack of affection and co-operation among its members. Joking relations are permitted in between consanguinal and affinal relatives. Pattapus and Palles follow the Hindu law of inheritance. All the male children have the right in their ancestral property. Their women enjoy equal status with men. While men catch the fish it is the women who market the fish and bring in the money which is the main support to the family. Thus they help in the smooth running of the family. A woman has more to do in the bringing up of a child in early stages and maintenance of family than that of a man, because the man is usually out of the house for fishing for a long

time every day and some times for 3 to 4 days at a stretch on the sea.

2.3.8 Dress and Ornaments

The women wear sarees and blouses, glass bangles, ear rings and nose rings adorn them. Like all Hindu women the Pattapu and Palle women also wear, invariably 'Bottu' (Vermilion dot) on their foreheads. The men wear 'dhoti' (piece of cotton cloth) to cover their lower parts and a shirt for to cover the upper parts. While at work men wear simply a gochi (small piece of cloth). The present youth of the fisherfolk villages are imitating the dress pattern of the town dwellers.

2.3.9 Life cycle rituals

Life cycle rituals are more or less same in Pattapu and Palle. They do not observe any pre-delivery rituals for the pregnant women. She is taken to her natal home for the first and second deliveries, either during the 7th month or the 9th month. Due to the non-availability of medical facilities in the immediate neighbourhood a majority of them conduct the deliveries at their home, with the help of expe-

rienced mantrasani (mid-wife). Purudu (Purification ceremony following the event of birth), first feeding ceremony, tonsuring and ear and nose piercing, puberty, betrothal ceremonies are not in practice. Marriage takes place at the bridegroom's residence for a day. Jandhyam (sacred thread) is worn before marriage day. In the evening of marriage day the secred thread, the threads which have been tied to the marriage pots and the milk post and grain seedlings used at the ceremony, are thrown into the sea. Shobanam (nuptial ceremony) is performed on the same day of marriage. On the fifth day after marriage, a Golla Perantalu (married women) is brought to the house in procession, walking on cloths spread on the ground (Nadapavada). She anoints the bridal couple with ghee (clarified butter) and after receiving a cloth as a presentation, goes away. The dead are burried in sleeping position and the Chinna and Pedda divasams are observed on 3rd and 13th day respectively.

2.3.10 Economic status

Both Pattapu and Palle occupy the same economic status and practising same traditional occupation i.e. fishing. Finance is the life blood of all economic activities in case of fishermen. Their socio-economic conditions are still

very poor. They depend on the finance supplied by fish merchants and agents. They link product market with capital market and exploit the fishermen. Besides fishing, during the lean season many of them (both men and women) work as daily-wage labourer in agricultural fields.

2.3.10.1 Division of labour

Division of labour is based on sex and age. The male in the family goes for fishing and other hard works, while the female besides attending to the domestic work she also participates in fish trade, selling of fish in the neighbouring villages and drying the fish catch. The people upto 15 years of age and after 60 years, participate in the repairs of the nets and the people between in the 15 to 60 years age group engage themselves in the netting operations.

2.3.10.2 Sharing of the Catch

Both caste groups practise the group fishing. The sharing of catch varies according to the size of the crew and types of nets. In group fishing, some times they spend 3 to 4 days on the sea. After the completion of the fishing expedition, the fish earnings will be distributed among the crew equally.

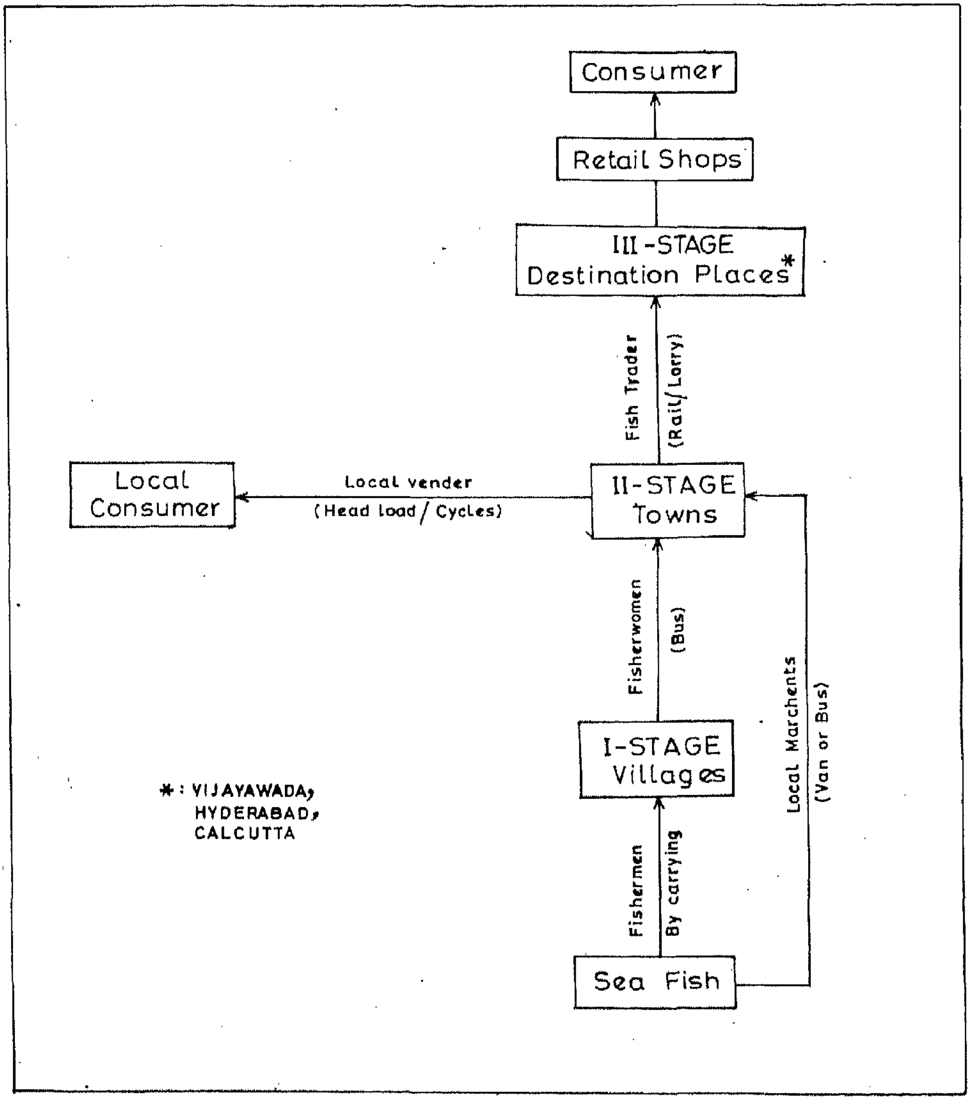


Fig. 1: A Schematic Diagram Showing the Flow of Fish Trade

2.3.10.3 Marketing

Marketing of marine fish is a daily phenomenon. The fish caught by the individual fishermen in the sea is disposed off to the local villagers or local merchants on head loads and on bus respectively by the women. Some local merchants themselves purchase the fish at sea coast itself and then move the bulk on bus or van to their towns like Nellore and Kavali. The daily marketing operation at these centres is considered to be the second stage of fish trade, which is largely handled by the established professional businessmen. The rate of fish or prawn are in accordance with the fish type, grade (size) and season; they are yet largely controlled by the second stage fish merchants. Keeping in view the prices at the second stage and transportation charges from village point to the town, the local merchant purchases fish from fishermen, who have no other alternative than to dispose of their catch as early as possible owing to its perishable nature. The second stage fish merchant exports fish to different destinations (Vijayawada, Hyderabad and Calcutta) either by road or train transportation. A very small percentage of the fish or prawn trade is carried out by local vendors who purchase the fish either directly from the fishermen or from the local merchants (see Fig. 1).

2.3.11 Technology

In the present study area fishing people catch fish with nets using catamarans locally known as 'teppas'.

2.3.11.1 Catamaran (Teppa)

Teppa in Telugu means anything that floats. Catamaran is derived from Tamil Kattumaran, Kattu means lashing and Maran - timber. Catamaran is a keel less raft formed by lashing together two or three logs of different sizes that are joined

Fig.2

by wooden nails. The fishermen combine the logs firmly together with ropes on either side when they go out for fishing and the logs are separated after returning. The logs at the lateral ends are slightly elevated. At the middle portion the catamaran is wider and it gradually tapers at the ends into a cone. The main advantage with the catamaran is that it will never sink. The wood they require for the preparation of the catamaran is Erra Chinduva (Albizzia Odoratissima), Tella Chinduva (Albizzia procera), Nidraganneru (Enterolobium Saman) and Badisa (Erythrina Indica)

2.3.11.2 Nets

In the present study area people are used Cila vala (drift net), Vaddi vala (drift net) and Iragavala (boat siene) as fishing nets for operation in the sea.

2.3.11.2.1 Cilavala (Drift net)

The Cila vala is a nylon gill net operated in deep sea. For each net there will be teppalu (floats) and budetalu (sinkers), fixed to the net at regular places. For each net 10 floats and 8 sinkers are fixed. Some fishermen by melting

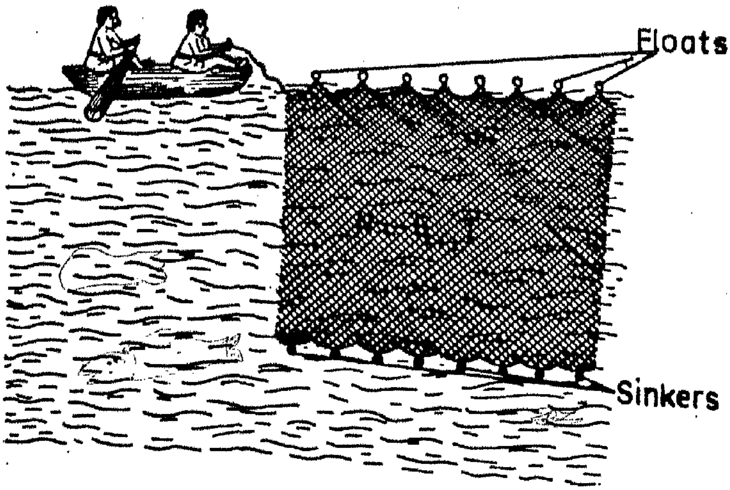


Fig.3

the old lead coins and converting it into sinkers for their nets. The mesh is three finger wide. The net is mainly

operated during October-November. Though they use the net in other months the yield is far less.

2.3.11.2.2 Vaddivala (Drift net)

The process of operation and preparation of the net are the same as that of the Cila vala. But the mesh width from knot to knot is much wider through which a hand easily passes. Hence only big varieties of fish are caught in this net. The period of operation of the net is from Kartika to Chitra Masa (October to March).

2.3.11.2.3 Iragavala (Boat siene)

Iraga vala is a primitive type of trawl net. The mouth of the net is kept stretched by means of two catamarans sailing at parallel course. The iraga vala is prepared out of 10 and 40 count cotton yarn. It consists of madi, melu madi, varamulu and tallu. The madi is a conical bag knitted very closely, made of cotton yarn which is truncated and is laced in such a way as to allow it for being opened readily for emptying. The mesh size is half an inch. The melu madi which is laced to the madi is made of cotton and the mesh size of which varies from one inch to two and half

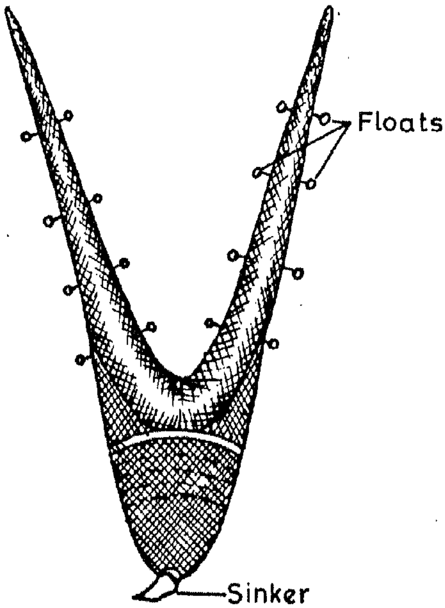
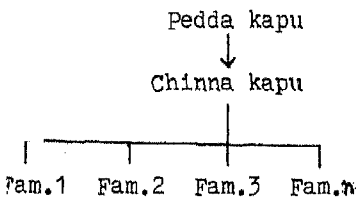


Fig.4

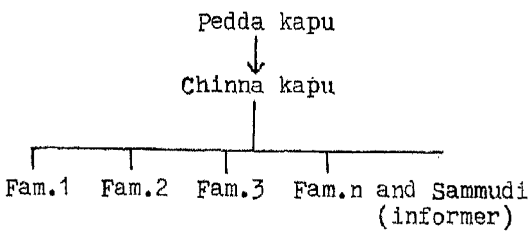
inches from the hind end to the mouth. Varamulu or wings are attached on either side of the melu madi. To the varamulu are attached lengthy ropes of coir called tallu which are in turn connected to the two catamarans. Each wing or varamu is attached to the either end of the mouth of the net which is about 70 feet in length. It gradually tapers to a point at the free end where it is furnished with a loop for the attachment of the warp. It is here where sinkers are fixed to the net. To the head rope of the net floats are attached at regular intervals. It is operated mainly during January-April.

2.3.12 Social control

The caste councils exist at village level among the Pattapus and Palles. In the village most of the families are interrelated by kinship bonds and affinities. These kinship links play a vital role in the elections of the Pedda kapu (Head man) and Chinna kapu, who are the decision makers in the socio-economic, religions activities of the caste and the other day to day affairs. Pattapus engage one sammudi (informer) who belongs to the Mala Caste for information to pass on from Pedda kapu to all families. In case of Palle this duty is undertaken by Chinna kapu. The caste council can fix any amount of fine or punishment on the defaulter or culprit, depending upon the nature of the case. In case of inter-caste marriage the couple are ex-communicated from their society.



PALLE



PATTAPU

2.3.13 Religious attributes

Pattapu and Palle are Hindus and profess Hindu religion. Like all other Hindus, they celebrate both great and little traditional festivals and rituals which are associated with fishing activities. Lord Venkateswara, Lord Rama temples are situated at the centre of the village and it is also the common meeting place for caste council and for person who are spending their leisure time. The fishing class worship the Akka Devatalu (sister deities) or Grama Devatalu (Village deities) periodically by floating on the surface of the water a flat frame work made of sticks tied together, on which the various articles used in the worship are placed. Before setting out on a fishing expedition they salute the God, the sea (Gangamma), and the nets and pray to their Gods to favour them with a big catch.

CHAPTER - III

MATERIAL AND METHODS

3.1. SELECTION OF THE POPULATION AND AREA

3.2. DISTRIBUTION OF THE SAMPLE

3.3. PRELIMINARY SURVEY

3.4. DATA COLLECTION

3.5. METHODS OF DATA COLLECTION

3.6. CONGENITAL MALFORMATION

3.7. TERMINOLOGY

3.8. ANALYSIS PROCEDURE

3.9. STATISTICAL CONSIDERATIONS

MATERIAL AND METHODS

The present study was undertaken among the Pattapu and Palle, the marine fishing communities in Nellore district of Andhra Pradesh, India.

3.1 SELECTION OF THE POPULATION AND AREA

The primary reason for selecting the above marine fishing caste populations is, that these two communities are having the same occupation and inhabiting the same ecological area but differ in their origin. Sanghvi's (1966) data suggest that the highest inbreeding coefficients are found in coastal Andhra Pradesh particularly in fishing

communities. Socio-economically they are backward. Finally, there is no comparative study among two caste groups with the same occupation (marine fishing) and who inhabit the same ecological area i.e., marine fishing zone.

The area selected for the present study is Pennar Coast in Nellore district of Andhra Pradesh. Though the fishing communities are widely spread over the coastal areas of Andhra Pradesh, the concentration of Pattapu caste is increased towards the South while Palle caste population is increased towards the North. But both caste groups are more or less equally concentrated in Nellore district particularly Kavali and Nellore Revenue divisions. Since the study was proposed on comparative basis, Pennar coast (Kavali and Nellore Divisions) was selected from Nellore district because of the equal concentration of Pattapu and Palle fishermen in this area. These areas enjoy similar climatic and environmental conditions.

3.2 DISTRIBUTION OF THE SAMPLE

The Pattapu and Palle populations of the present study are represented from the coastal areas of Nellore and Kavali Revenue Divisions. The data on 1,182 marriages have been collected from 12 villages of these two revenue divisions of Nellore district, Andhra Pradesh. Out of 1,182 families,

638 families were drawn from Pattapu caste and the rest i.e., 544 families from Palle caste. The villages are selected such that by and large, both castes under study live-in side by side villages within the radius of five kilometers in Nellore and Kavali Revenue Divisions. The villagewise distribution of couples in Pattapu and Palle caste groups with their percentages are presented in Table 1.

TABLE 1

Village-wise sample distribution of Pattapu and Palle in the Present study

Sl. No.	Name of the village	No. of (families) marriages	Percentage
PATTAPU			
1.1	Mypadu Pattapu Palem*	145	22.73
1.2	Utukur	95	14.89
1.3	Venkateswara Puram	141	22.10
1.4	Thummala Penta	143	22.41
1.5	Kothasathram	114	17.87
	Total	638	100.00
PALLE			
2.1	Gangapatnam*	77	14.16
2.2	Kudithi Palem	79	14.52
2.3	Utukur	102	18.75
2.4	Vattur	112	20.59
2.5	Thummalapenta	69	12.68
2.6	Sriram Puram	47	8.64
2.7	Ramudu Palem	58	10.66
	Total	544	100.00

* Figure 5 shows location of 12 villages as per the serial number in the table.

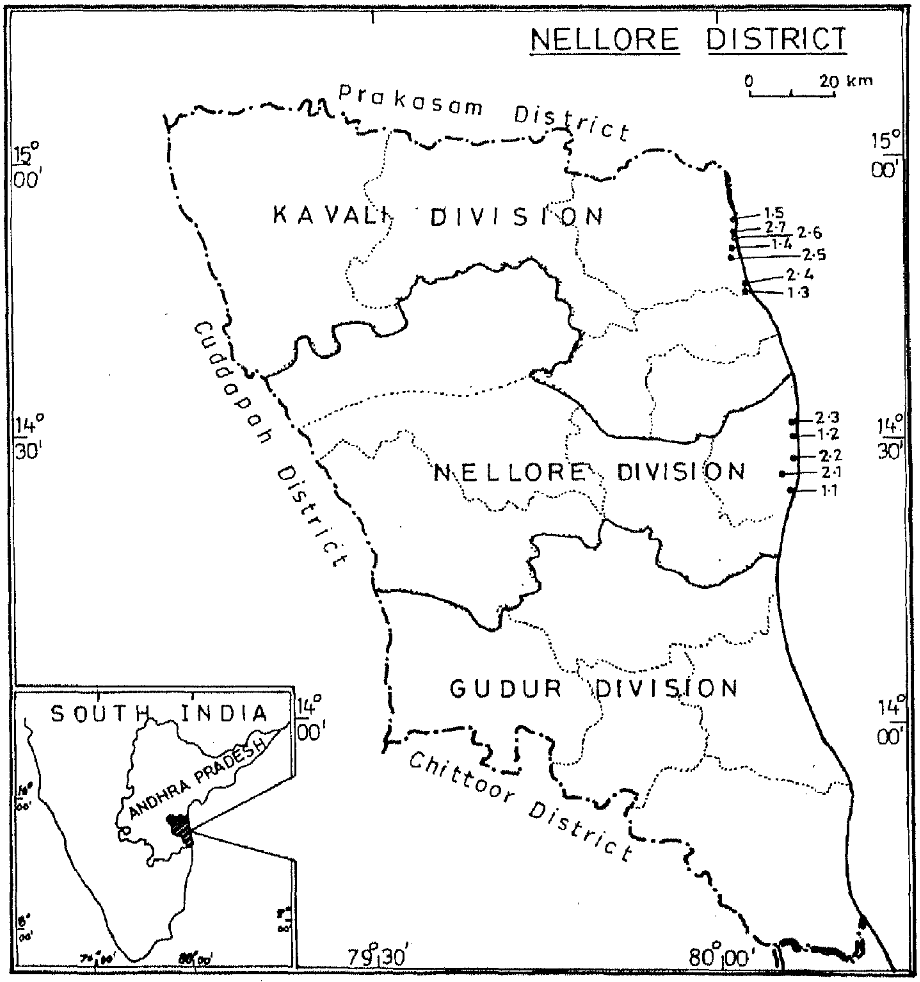


Fig. 5: Nellore District showing area under study

3.3 PRELIMINARY SURVEY

Two months before the commencement of field work, a pilot survey was conducted in order to plan and determine the methods of data collection. Accordingly, different interview schedules were prepared.

3.4 DATA COLLECTION

The field work was conducted during 1988-89. Before starting the field work, rapport has been established with the village Head-Man to organise the field work. After the purpose of enquiry is briefed to the head-man (Peddakapu), he used to announce to the villagers to co-operate by providing necessary information from each house-hold. The rapport has been further developed by giving gifts to the children and by calling elder person with kinship terms like tata (grand-father) and avva (grand-mother). Through them the author got good propaganda which helped to get reliable data without any complication. For the collection of data, two types of interview-schedules were used : house hold record schedule and personal record of married women, which were developed on the basis of extensive review of available literature and discussions with experts in the field. The

specimen copies of these two schedules are appended (appendices I and II).

The household record schedule was used to collect information on demographic and socio-economic aspects of the household members. This schedule contains the different columns like town/village, household number, income, names of household members, their sex, relation to the head of the household, marital status, education besides particulars on family planning.

The schedule on personal record of married women was used to collect the reproductive history of married women and other related aspects. This schedule contains the information such as marital distance, age at menarche, age at menopause, type of consanguineous marriage and women's reproductive history.

3.5 METHODS OF DATA COLLECTION

3.5.1 Age estimation

Most of the Pattapu and Palle people are illiterates, and usually they do not keep records of their age. As a result, it became difficult to get their exact ages. Maximum

care was taken in order to obtain the nearest possible estimates. The reported ages were cross checked, for example, by asking/by assessing the age of the first child which would be comparatively easier to guess; the gap between marriage and first child birth; in case of women, whether she get married before or after puberty, if so, what was the gap? etc., which were found extremely useful in assessing the ages of couples. This is specially true because the marriage age generally does not vary much. Few of them maintained horoscopes which helped in recording the age. Some times physical appearance of the persons was considered in estimating the age. Also on the basis of natural calamities like cyclone (locally called Pedda Galivana) occuring in the study area, the age was estimated.

3.5.2 Ascertaining consanguinity

Consanguinity was ascertained with the help of pedigrees, which are drawn by the author after interviewing the respondents. The local terms for different kinds of relationships were found useful to the extent of ascertaining whether a particular couple were consanguineously related or not. But at the same time this method was highly delusive if taken casually. For example, the people generally call

their cousin sister (1st cousin) or even a distant one as sister. During the present study many such cases were encountered. For example, father's brother's daughter's daughter ($1\frac{1}{2}$ cousin) is generally referred to as sister's daughter (uncle-niece). Similarly, father's counsin sister's daughter (2nd cousin) was often referred to as father's sister's daughter (1st cousin). In such cases repeated cross questions for drawing the pedigrees was extremely helpful in ascertaining the exact relationship between the couple.

3.5.3 Marital Distance

Distance between the birth places of the spouses were recorded in Kilometers, along travel route and not by crow fly distance. The distance for those married in the same village was recorded as zero. The reported distance was some times estimated from the exact amount of fare fixed for the destination, the mode of transport used, etc.

3.5.4 Pregnancy histories

Pregnancy histories were collected interviewing mostly women. Husbands, when present, are generally found corroborating with the information given by their wives. Special

care has been taken in recording pregnancy wastages since very often it has been complained that they were, probably, under reported. The information on reproductive histories was simple and limited to recording as to how many live births and wastages a woman had, what is the sex composition? How many died and at what age? and what is the sex of the dead.

3.6 CONGENITAL MALFORMATION

The externally visible congenital malformations were recorded following the methods suggested by Weiner and Lourie (1969). Unfortunately in the present study only two cases each observed in Pattapu and Palle populations. Out of this, malformation of Deaf and Dumb observed each in consanguineous couples of both communities. Remaining two, a cleft lip in Pattapu and polydactyly in Palle are observed in non-consanguineous couples. Due to the low frequency of congenital malformations in the present study, it is not possible to see the effect of consanguinity on this parameter.

3.7 TERMINOLOGY

The following terms have been used in the study according to the difinitions given for each.

3.7.1 Duration of effective married life

This is calculated by taking into consideration the actual period from the year of marriage/consummation to sterilization/widowhood/separation/year of investigation depending on the case which ever is the appropriate. This definition is used in studying fertility (pregnancies and live births and surviving offspring).

3.7.2 Prenatal deaths

It includes all foetal deaths before birth. They are classified into abortions and still births. Abortions mean foetal loss upto and including 6th month of gestation. Still-births mean foetal deaths from the start of 7th month to after upto birth.

3.7.3 Post-natal deaths

Deaths after birth are known as post-natal deaths. They are classfied into neo-natal deaths (deaths under 28 days), post-neonatal deaths (deaths from 28 days to 365 days), infant deaths (neonatal and post-neonatal deaths i.e., 0 to 1 year) and child deaths (1 to 14 years and 0-14 years). Total deaths include both pre-natal, and post-natal deaths.

3.7.4 Mortality rates

The following formulae were used in estimating the mortality rates:

$$\text{Total foetal loss rate} = \frac{\text{Total foetal loss reported}}{\text{Total pregnancies reported}} \times 100$$

$$\text{Neonatal mortality rate} = \frac{\text{No. of deaths under 28 days}}{\text{No. of live births observed}} \times 100$$

$$\text{Post-neonatal mortality rate} = \frac{\text{Deaths of infant of age 28 days to under one year}}{\text{Live births-neonatal deaths}} \times 100$$

$$\text{Infant mortality rate} = \frac{\text{No. of deaths under one year of age}}{\text{No. of live births observed}} \times 100$$

$$\text{Post-natal mortality rate (1 to 14 years)} = \frac{\text{No. of post-natal deaths (1 to 14 years)}}{\text{No. of live births-infant deaths}} \times 100$$

$$\text{Post-natal mortality rate (0 to 14 years)} = \frac{\text{No. of post-natal deaths (0 to 14 years)}}{\text{No. of live births observed}} \times 100$$

$$\text{Total mortality rate} = \frac{\text{No. of pre-natal and post natal deaths}}{\text{No. of pregnancies observed}} \times 100$$

3.8 ANALYSIS PROCEDURE

The data were analysed by coding, tabulation and statistical computation. The data tabulated for the demographic parameters such as age, sex composition, marital status, age at menarche, age at marriage, marital distance, fertility, mortality and consanguinity, sex ratio, breeding size, dependincy ratio, aging index, etc., have been calculated. The following formulae were used to compute the data to get an idea about the genetic implications of the population structure.

3.8.1 Sex Ratio

Expressed as the number of males per 100 females

$$\text{i.e. } \frac{\text{Males}}{\text{Females}} \times 100$$

3.8.2 Aging Index

The aging of population can also be described as the increase in the relative number of older people in the population. It can be measured by using the formula given below:

$$\text{Aging Index} : \frac{\text{Persons of age 60 years and over}}{\text{Children of age 14 years and under}} \times 100$$

3.8.3 Dependency ratio

Dependency ratio is another important measure of the age distribution of a population. It describes the number of dependent persons that are supported by the active or working member of the population.

$$\text{Child dependency ratio} = \frac{\text{Children below age 15 years}}{\text{Persons of 15-59 years of age}} \times 100$$

$$\text{Old age dependency ratio} = \frac{\text{Persons of age 60 years and over}}{\text{Persons of 15-59 years of age}} \times 100$$

Total dependency ratio = Child dependency ratio + Old age dependency ratio.

3.8.4 Breeding size (N)

Breeding size constitutes the number of actual progenitors or parents. It has been determined in both caste groups, following the suggestions of Freire-Maia (1974). Usually 35% of the total population is represented as bredding size.

3.8.5 Effective population size (Ne)

The effective population size (Ne) was calculated for both castes according to Wright's (Cf. Sen, 1976) formula.

$$Ne = \frac{N\bar{K}\,(N\bar{K} - 1)}{(N-1)\,\sigma^2 K + N\bar{K}\,(\bar{K}-1)}$$

where, N = stands for breeding size

$\bar{K}$ = Mean number of offspring per couple

σ^2 K = Variance $\bar{K}$

Usually 25% of total population size is effective size (Freire-Maia, 1974).

3.8.6 Variance due to the random Genetic Drift

The effective size of the population is important in order to quantify changes due to random drift. The variance due to random drift has been calculated according to the formula (Wright, 1940) mentioned below:

$$\sigma_{dq}^2 = \frac{q\,(1-q)}{2\,Ne}$$

where, σ_{dq}^2 is the variance due to drift

q stands for the gene frequency (usually taken as 0.5) and

Ne represents the effective population size

3.8.7 Index of opportunity for selection (I)

The opportunity for natural selection (I) has been estimated using the index proposed by (A) Crow (1958) (B) Johnston and Kensinger (1971) which takes into account the contribution of pre-natal mortality and (c) further modification (Hed, 1984) that takes into account the contribution to the index of childless women.

$$I = Imc + \frac{If}{Ps} \quad \text{.. .. .. ..} \quad (A)$$

$$I = Ime + Imc/Pb + If/PbPs \quad \text{..} \quad (B)$$

$$I = Im + Iso + Isf$$

(OR)

$$\frac{Pd}{Ps} + \frac{Pso}{Psf} \times \frac{1}{Ps} + \frac{Vsf}{\bar{X}^2\ sf} \times \frac{1}{Ps} \times \frac{1}{Psf} \quad \text{.. ..} \quad (C)$$

where,

I = Index of opportunity of selection

$$Imc = Im = \frac{\text{Proportion of children who died below 15 years age}}{\text{Proportion of survivors upto 15 years age}}$$

$$= \frac{Pd}{Ps}$$

$$I_f = \frac{\text{Variance of the No. of live born}}{\text{Square of the mean No. of live born}} \rightarrow \frac{V_f}{\bar{X}^2}$$

$$I_{me} = \frac{\text{Proportion of embryonic deaths}}{\text{Proportion of survivors to birth}} = \frac{P_{ed}}{P_b}$$

$P_b\ P_s$ = Proportion of survivors, early embryo to 15 Years of age

P_{so} = Proportion of childless women

P_{sf} = Proportion of women with children $(1 - P_{so})$

V_{sf} = Variance in sibship size among child bearing women

$\bar{X}^2_{sf}$ = mean sibship size, squared, of childbearing women

I_{so} = the contribution to the fertility component by childless women

I_{sf} = the contribution to the fertility component by child bearing women

In the present study the data on mothers, who reached menopausal age and couples, who adopted the family planning were considered.

3.8.8 Computation of inbreeding coefficient from pedigrees

Inbreeding coefficients for autosomal genes (FA) and sex linked gene (FX) were computed by the method of Wright (1921)

The general formula used for computing inbreeding coefficient from a pedigree was as follows:

$$F = \sum \left(\tfrac{1}{2}\right)^n (1 + F_c)$$

where

Fc = Inbreeding coefficient of common ancestor, if he is inbreed (otherwise it is taken as zero)

n = Number of persons along a geneological path connecting one parent to the other through the common ancestor

Summation is taken over all geneological path connective spouses.

For sex-linked inbreeding coefficient (FX), all geneological paths having two males in succession are excluded, and 'n' is the number of only the females along the geneological path connecting the parental gamets through the common ancestor.

3.8.9 Standard error of Mean Inbreeding Coefficient

$$\text{S.E. of F} = \sqrt{\frac{V(F)}{\Sigma mi}}$$

where

V(F) represents variance, obtained as

$$V(F) = \frac{\Sigma Fi^2\, mi - \left[(\Sigma Fimi)^2 / \Sigma mi\right]}{\Sigma mi - 1}$$

Fi = Inbreeding coefficient in the ith group (a particular category of consanguineous marriages)

mi = No. of persons in that group

3.8.10 Regression analysis of mortality rate on inbreeding

The regression coefficients ('B) for mortality and inbreeding (F) and the values of intercept A, were estimated

by fitting the data to exponential model.

$$Pi = 1 - e^{-(A+B\ Fi)}$$

Where

Pi = expected proportion of survivors upto the actual start of reproduction

and

Fi = inbreeding coefficient of ith inbred class

The A and B values from equation were obtained through weighted least squares technique of Smith (1967) and goodness of fit tested using appropriate distribution.

The estimates are made for four classes of mortality (1) FD-Foetal deaths (2) ID - Infant deaths (3) PRD-Pre-reproductive deaths (mortality from birth upto the actual start of reproduction) (4) TM-Total mortality (FD+ID+PRD).

The estimate A represents random load and includes all mortality due to non-genetic causes and a portion due to genetic causes that expresses under random mating itself. The B estimate represents the load from inbreeding and includes all mortality due to homozygosity of recessive lethal genes as a result of parental consanguinity (Morton et al. 1956).

3.9 STATISTICAL CONSIDERATIONS

The following statistical tools were used in the analysis of the data.

3.9.1 Arithmetic Mean ($\bar{X}$)

It is one of the measures of location. It was calculated by adding and dividing the sum by the total number of values.

$$\bar{X} = \frac{\Sigma X}{N}$$

Where

$\bar{X}$ = Mean value

X = Sum of all values

N = Number of values

3.9.2 Standard Deviation (σ)

It is one of the measures of dispersion. It was calculated by finding the square root of the average of the deviation from mean squared. The following formula was used in computing the standard deviation.

$$\sigma = \sqrt{\frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2}$$

3.9.3 Standard Error (S.E) of Mean ($\bar{X}$)

It indicates the magnitude of sampling error. The size of the sampling error varies with the sample size and its variation as well as the statistics involved. It was calculated as follows:

$$S.E = \frac{\sigma}{\sqrt{N}}$$

3.9.4 Chi-Square test (χ^2)

To test the significant difference between the observed (oi) and expected (e) number for a given set of variables (K) distributed in r x c contingency tables, the following formula was applied.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

The degree of freedom is noted as (number of categories in rows -1) x (number of categories in colums -1).

3.9.5 Proportion test

To test the significant difference between two proportions - z - test. The standard error of the difference between the proportions

$$S.E.\ Diff.\ (P1-P2) = \sqrt{\frac{Pq}{n1} + \frac{Pq}{n2}}$$

Where

$$P = \frac{n_1 P_1 + n_2 P_2}{n_1 + n_2} = \text{best estimate of proportion in the population}$$

$$q = 1 - P$$

test statistic

$$z = \frac{P_1 - P2}{\sqrt{Pq/n_1 + Pq/n_2}}$$

$$= \frac{\text{Difference in proportions}}{\text{Standard error of the difference in proportions}}$$

3.9.6 To test the significance difference between means in large samples

The t values were computed to know the significant difference, if any, between the mean values of quantitative variables using the following formula:

$$t = \frac{|X1 - X2|}{\sqrt{S.E_1^2 + S.E_2^2}}$$

Where

$\bar{X}_1$ = mean of the variables of first sample
$\bar{X}_2$ = mean of the variables of second sample
$S.E_1$ = standard error of $\bar{X}_1$
$S.E_2$ = standard error of $\bar{X}_2$
n_1 = size of the first sample
n_2 = size of the second sample

3.9.7 Exponential Model

To study the relationship between consanguinity and marital distance, the following trend equation have been used.

Consider exponential relationship $y = ae^{bT}$

where

y = Dependent Variable

T = Marital distance

a and b are unknown constants, which are usually called parameters of the relationship.

b is also called an exponential growth (increment) rate which can be usually expressed in percentages. It can be computed by using the following formula

$$\hat{b} = \left[\frac{\Sigma YT - \frac{(\Sigma Y)(\Sigma T)}{n}}{\Sigma T^2 - \frac{(\Sigma T)^2}{n}} \right]$$

For testing the significance of growth (increment) rates the 't' test of the following form is used

$$t = \frac{\hat{b}\sqrt{\Sigma T^2 - \frac{(\Sigma T)^2}{n}}}{\hat{\sigma}}$$

where

$$\hat{\sigma} = \sqrt{\frac{\left[\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right] - \hat{b}\left[\Sigma YT - \frac{(\Sigma Y)(\Sigma T)}{n}\right]}{n-2}}$$

Here n = No. of observations on each variable

Compare the calculated value of 't' statistic with the critical value of 't' for n-2 degrees of freedom at 5% level of significance and draw the inference accordingly.

3.9.8 Analysis of variance (ANOVA) Technique for one way classified data with unequal number of observations

In the present study unequal number of percentage observations were converted to normal observations by using $\sin^{-1}$ arc transformation. From these values, the ANOVA table have been given below.

ANOVA TABLE

Source of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F-test statistic	
Between groups	K - 1	BSS	$\frac{BSS}{K-1.} = M$	$F_{cal} = \frac{M}{K}$	$F_{cal\,(K-1).(n-K)}$
Error	n - K	ESS	$\frac{SS}{n-K} = K$	–	
Total	n - 1	TSS	–	–	–

3.9.9 Stepwise multiple regression analysis of consanguinity and different fertility and mortality measures was done by entering the independent variables given correspondingly.

Dependent variables	Independent variables
A. Consanguinity	1. Age at puberty 2. Age at marriage 3. Marital distance 4. Duration of effective married life 5. Pregnancies 6. Live births 7. Surviving offspring 8. Family planning 9. Income
B. Fertility measures i) Pregnancies ii) Live births iii) Surviving offspring C. Mortality Measures i) Foetal loss ii) Infant mortality iii) Post-natal (1-14 years) mortality iv) Post-natal (0-14 years) mortality	1. Age at puberty 2. Age at marriage 3. Duration of effective married life. 4. Pregnancies 5. Live births 6. Surviving offspring 7. Family planning 8. Income

CHAPTER - IV

SECTION - A

POPULATION COMPOSITION AND INBREEDING

4A.1. AGE AND SEX COMPOSITION

4A.2. MARITAL STATUS

4A.3. SEX RATIO

4A.4. CHILD-WOMEN RATIO

4A.5. AGING INDEX AND DEPENDENCY RATIO

4A.6. BIO EVENTS (or) DEMOGRAPHIC ASPECTS

4A.7. PATTERN AND PREVALENCE OF CONSANGUINEOUS MARRIAGES

4A.8. OCCURENCE OF CONSANGUINEOUS MARRIAGES AMONG THE VILLAGES

4A.9. INBREEDING COEFFICIENT

4A.10. TEMPORAL TREND OF CONSANGUINITY

4A.11. PREDICTION OF CONSANGUINITY WITH SOCIO-ECONOMIC, DEMOGRAPHIC AND BIOLOGICAL VARIABLES

4A.12. ENDOGAMY AND MEAN MARITAL DISTANCE (MMD)

4A.13. MEAN MARITAL DISTANCE (MMD) AND VILLAGE ENDOGAMY VILLAGE WISE

POPULATION COMPOSITION AND INBREEDING

In the present chapter, the emphasis is on the demographic parameters of two populations which are essential to interpret the genetic variation with the help of existing models. The analysis of data and results pertaining to the most important demographic factors which explain the structure of population such as age-sex composition, types of marriage, age at menarche, age at menopause, marital distance, fertility and mortality are presented followed by the discussion. The results of the present study are also compared with those of the other populations on whom similar studies have been carried out in Andhra Pradesh.

4A.1 AGE AND SEX COMPOSITION

The age and sex composition among the Pattapu and Palle were taken into consideration and the results have been presented in tables 2 & 3 and figures 6 and 7. In the Pyramid, the per cent frequency in each female age-group in respect of total number of males and females is plotted on the right side and the corresponding per cent frequencies of males in respective age-groups are plotted on the left. It is evident from these tables (2 and 3) and figures (6 and 7) that the two castes tend to show in general, a broad based younger age-groups 0-4, 5-9 and 10-14 years and it tapers as moved on to older age-groups - a characteristic of potentially growing population noticed in developing countries like India (Krishnan, 1971). In the population pyramid whatever the fluctuations or ups and downs observed in the age and sex composition in two populations may be due to mortality and fertility in different age and sex groups. There are more males than females in many age groups of Palle but in Pattapu about half of the total age-groups show more females (5-9 to 25-29, 45-49 to 55-59 and 65-69 age groups) and the remaining show male domination.

It is observed that both the castes show constrictions at the base of the pyramid in the age group of 0-4 years.

TABLE - 2

AGE AND SEX COMPOSITION OF PATTAPU

Age Group (Yrs.)	Male		Female		Sex Ratio
	No.	%	No.	%	
0 - 4	210	14.74	196	14.19	107.14
5 - 9	232	16.28	236	17.09	98.31
10 - 14	171	12.00	174	12.61	98.28
0 - 14	613	43.02	606	43.89	101.15
15 - 19	114	8.00	121	8.76	94.21
20 - 24	98	6.88	120	8.69	81.67
25 - 29	130	9.12	144	10.43	90.28
30 - 34	125	8.77	71	5.14	178.87
35 - 39	75	5.26	57	4.12	131.58
40 - 44	57	4.00	47	3.40	121.28
15 - 44	599	42.03	560	40.54	106.96
45 - 49	41	2.88	50	3.62	82.00
50 - 54	46	3.23	52	3.77	88.46
55 - 59	42	2.95	47	3.40	89.36
60 - 64	40	2.81	29	2.10	137.93
65 - 69	20	1.40	26	1.88	76.92
70 - 74	19	1.33	6	0.43	316.67
75 - 79	3	0.21	1	0.07	300.00
80 - 84	2	0.14	4	0.29	50.00
45 - 84	213	14.95	215	15.56	99.06
Total	1,425	100.00	1,381	100.00	103.19

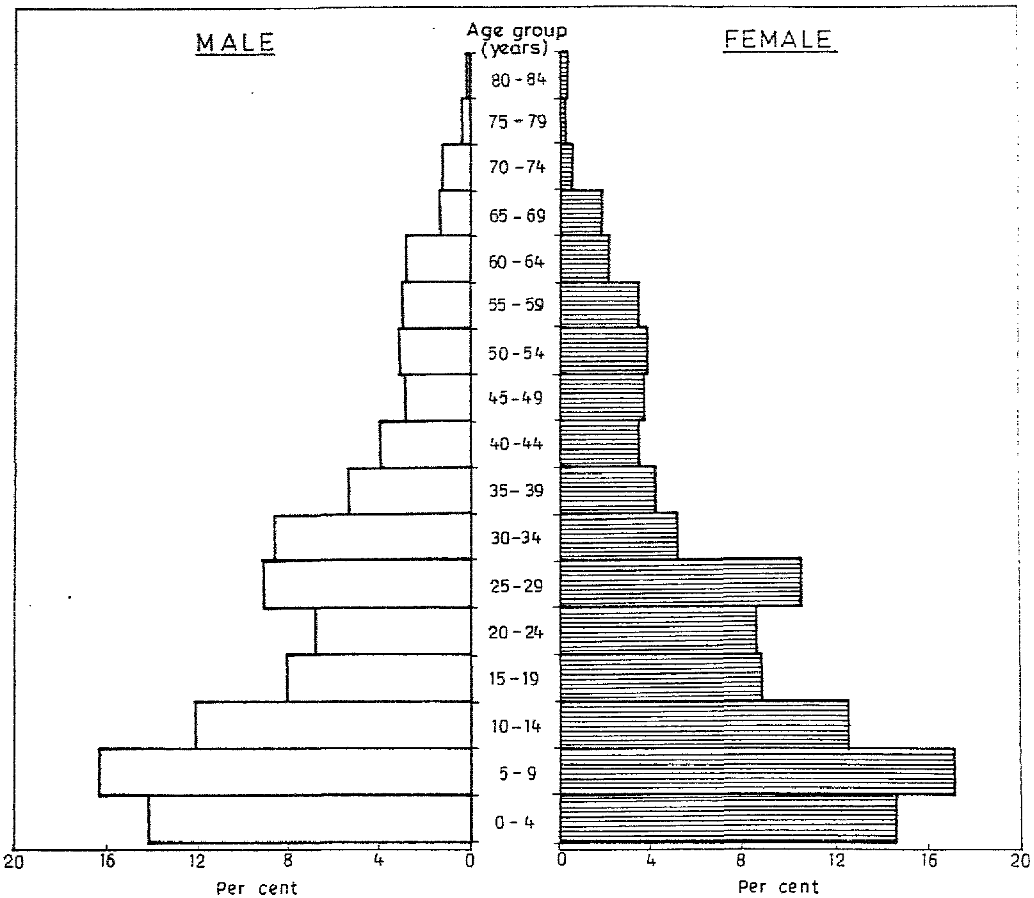


Fig. 6 :Population pyramid for Pattapu

TABLE - 3

AGE AND SEX COMPOSITION OF PALLE

Age Group (Yrs.)	Male		Female		Sex Ratio
	No.	%	No.	%	
0 - 4	147	12.22	140	12.27	105.00
5 - 9	198	16.47	183	16.04	108.20
10 - 14	152	12.64	137	12.01	110.95
0 - 14	497	41.33	460	40.32	108.04
15 - 19	102	8.48	116	10.17	87.93
20 - 24	100	8.32	126	11.04	79.37
25 - 29	105	8.74	113	9.90	92.92
30 - 34	93	7.74	58	5.08	160.34
35 - 39	65	5.41	56	4.91	116.07
40 - 44	56	4.66	50	4.38	112.00
15 - 44	521	43.35	519	45.48	100.39
45 - 49	43	3.58	49	4.29	87.76
50 - 54	36	3.00	36	3.15	100.00
55 - 59	30	2.50	31	2.72	96.77
60 - 64	37	3.08	29	2.54	127.59
65 - 69	20	1.66	14	1.23	142.86
70 - 74	11	0.92	2	0.18	550.00
75 - 79	7	0.58	1	0.09	700.00
45 - 79	184	15.32	162	14.20	113.58
Total	1,202	100.00	1,141	100.00	105.35

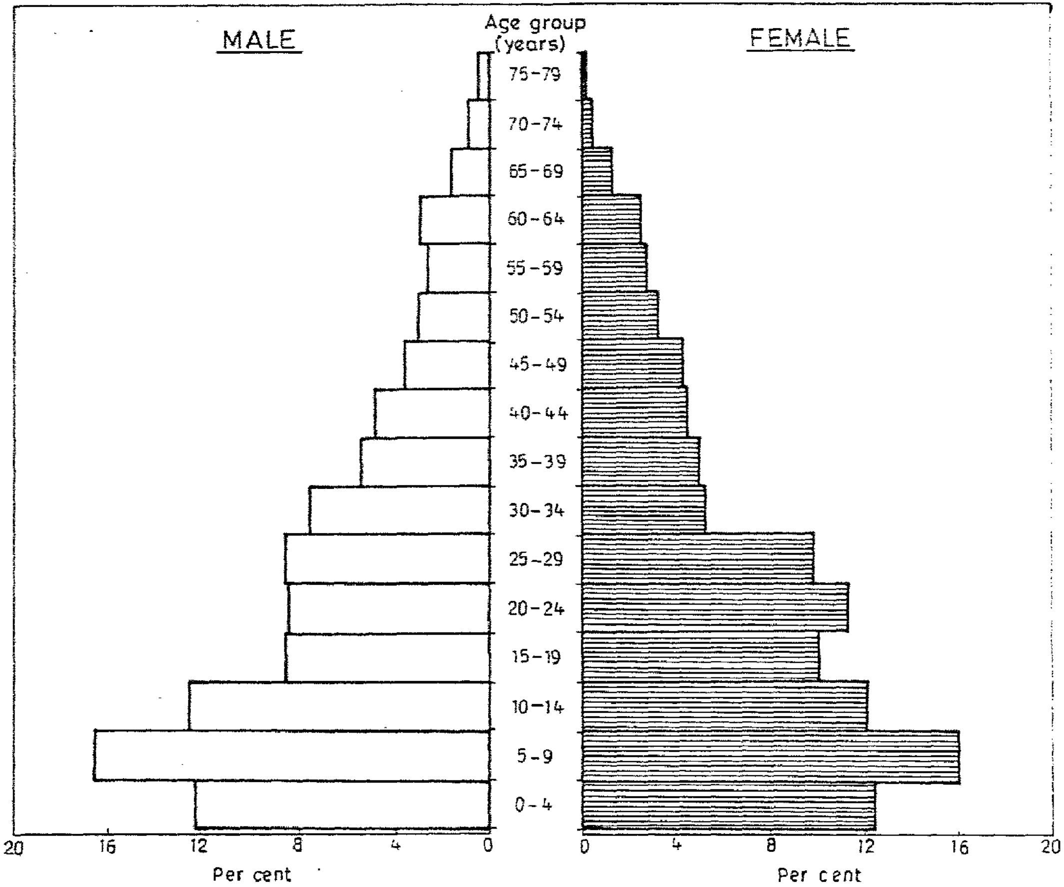


Fig. 7 :Population Pyramid for Palle

This suggests a recent trend of either a drop in fertility which is an effect of adoption of family planning program in the recent years or high infant mortality. In general, both castes show wide base (0-4 and 5-9 year age groups) of the pyramid. It is an indication of higher number of persons in the younger age-group because of high fertility and high mortality rates in the population, particularly of high infant mortality.

About 3.5 per cent and 2 per cent individuals among Pattapu are in excess of Palle population in the age class of 0-14 years i.e. pre-reproductive phase of females and males respectively. There is a fall in the number of males (by about 1 per cent) and females (by about 3 per cent) in Pattapu from the age class of 0-14 years to the age class of 15-44 years (reproductive phase). But an almost reverse trend is found in the age class of 0-15 years to the age class of 15-44 years, in which increased the number of males (by about 2 per cent) and females (by about 5 per cent) in Palle. There is a sudden fall in the number of males (by about 65 per cent in both caste groups) and females (by about 60 per cent for Pattapu and 70 per cent for Palle) from the age class of 15-44 years to the age class of 45-49 years and above i.e. post-reproductive phase.

A high infant mortality could be presumed among the Pattapu and Palle in view of the lack of proper medical facilities, unhygenic living conditions, prevalence of epidemics and certain diseases especially the tetanus, diptheria, whooping cough, small pox, some other viral infectuous diseases, environmental and nutritional problems.

4A.2 MARITAL STATUS

The marital status by age and sex in Pattapu and Palle castes are presented in tables 4 and 5 respectively. Marital status of the individuals in a population also affects its growth directly. The level of fertility in a population is influenced by the number of cohabiting couples rather than mere number of fertile males and females present in a population; and the extent of which marriages also dissolved by death and divorce. All these factors can affect the birth rate.

As expected, the number of unmarried males who are under the age group of 0-29 years are more in number than that of the married males. Out of the 791 unmarried Pattapu and 647 Palle males about 99 per cent members are below 25 years of age. Only one unmarried male in Pattapu as well as Palle community has been observed beyond 39 years of age due to the physically handicapped and mental retardation respectively.

MARITAL STATUS BY AGE AND SEX IN PATTAPU

	Unmarried				Married				Widowed + Seperated			
	Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 4	210	26.55	196	28.95	-	-	-	-	-	-	-	-
5 - 9	232	29.33	236	34.86	-	-	-	-	-	-	-	-
10 - 14	171	21.62	172	25.41	-	-	2	0.32	-	-	-	-
15 - 19	112	14.16	63	9.30	2	0.32	58	9.33	-	-	-	-
20 - 24	58	7.33	7	1.03	40	6.43	109	17.52	-	-	4	4.88
25 - 29	7	0.83	2	0.30	122	19.61	141	22.67	1	8.33	1	1.22
30 - 34	-	-	1	0.15	125	12.10	66	10.61	-	-	4	4.88
35 - 39	-	-	-	-	75	12.06	55	8.84	-	-	2	2.44
40 - 44	1	0.13	-	-	56	9.00	44	7.08	-	-	3	3.66
45 - 49	-	-	-	-	39	6.27	43	6.91	2	16.67	7	8.54
50 - 54	-	-	-	-	45	7.24	40	6.43	1	8.33	12	14.62
55 - 59	-	-	-	-	41	6.59	40	6.43	1	8.33	7	8.54
60 - 64	-	-	-	-	38	6.11	14	2.25	2	16.67	15	18.29
65 - 69	-	-	-	-	19	3.06	9	1.44	1	8.33	17	20.73
70 - 74	-	-	-	-	16	2.57	1	0.16	3	25.01	5	6.10
75 - 79	-	-	-	-	3	0.43	-	-	-	-	1	1.22
80 - 84	-	-	-	-	1	0.16	-	-	1	8.33	4	4.88
Total	791	100.00	677	100.00	622	100.00	622	100.00	12	100.00	82	100.00

TABLE – 5

MARITAL STATUS BY AGE AND SEX IN PALLE

Age Group (Yrs.)	Unmarried				Married				Widowed + Seperated			
	Male		Female		Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 – 4	147	22.72	140	26.87	–	–	–	–	–	–	–	–
5 – 9	198	30.60	183	35.12	–	–	–	–	–	–	–	–
10 – 14	152	23.49	137	26.29	–	–	–	–	–	–	–	–
15 – 19	97	14.99	50	9.60	5	0.94	65	12.17	–	–	1	1.16
20 – 24	44	6.80	8	1.54	54	10.11	114	21.35	2	9.52	4	4.65
25 – 29	7	1.08	3	0.58	98	18.35	100	18.73	–	–	10	11.63
30 – 34	1	0.16	–	–	91	17.04	52	9.74	1	4.76	6	6.98
35 – 39	–	–	–	–	65	12.17	50	9.36	–	–	6	6.98
40 – 44	1	0.16	–	–	55	10.30	44	8.24	–	–	6	6.98
45 – 49	–	–	–	–	43	8.05	45	8.43	–	–	4	4.65
50 – 54	–	–	–	–	33	6.18	29	5.43	3	14.29	7	8.14
55 – 59	–	–	–	–	27	5.06	17	3.18	3	14.29	14	16.28
60 – 64	–	–	–	–	30	5.62	12	2.25	7	33.33	17	19.76
65 – 69	–	–	–	–	19	3.56	6	1.12	1	4.76	8	9.30
70 – 74	–	–	–	–	11	2.06	–	–	–	–	2	2.33
75 – 79	–	–	–	–	3	0.56	–	–	4	19.05	1	1.16
Total	647	100.00	521	100.00	534	100.00	534	100.00	21	100.00	86	100.00

Majority (98 per cent) of the unmarried females are below 20 years of age in both castes. One female of Pattapu remained unmarried beyond 29 years of age due to handicappedness. The proportion of married males to that of married females is equal in both castes. Majority of the married males are aged 25 years and above, while a large proportion of married females are aged 20 years and above in both castes. The frequency of married females in lower age groups is higher than males indicating early marriage in them. Majority of widowed and separated males (about 91 per cent in Pattapu and 86 per cent in Palle) are aged 45 years and above, while the females are aged 40 years and above (about 86 per cent in Pattapu and 69 per cent in Palle) indicating that very few women of reproductive age were spared the task of child bearing. Thus, the marital status of the two castes clearly marks the universality of marriage, possibility of early marriageable age for girls and marital stability that are conducive for high fertility as it has also been observed in a study by Nag (1980).

4A.3 SEX RATIO (SEX COMPOSITION)

Sex ratio is additional relevant factor of population growth. It measures the number of males per 100 females in

a population where 100 being the point of balance; lesser or greater value to this indicate an excess of females or males respectively. Both marine fishing communities make known distorted sex ratios in each and every age group (fig. 8) but no definite trend is possible to perceive. The sex ratios of Pattapu and Palle among the unmarried, married and, widowed and separated individuals are 116.84, 124.18; 100.00, 100.00; and 14.63, 24.42 respectively. The overall sex ratio is 105 in Pattapu, 103 in Palle. The trend of sex ratio shows that in general there is a progressive diminution in excess of males over females which may be attributed to lower birth rate or higher death rates of females resulted from the neglect of female children. This tendency seems to be similar in 0-14 years and 15-44 years age group for both communities. This may be due to a high mortality rate among the females, who may perhaps, be more susceptible to endemic diseases than the males. Another factor adding to lower male death rate may be better care males receive during sickness as well as in good health in both castes. Females are not only being neglected during their ill health but also exposed themselves to harsh weather condition.

The excess of males in age group of 45 years or over is observed in the Palle, indicating a long lifespan of males to that of females. It may be due to the higher

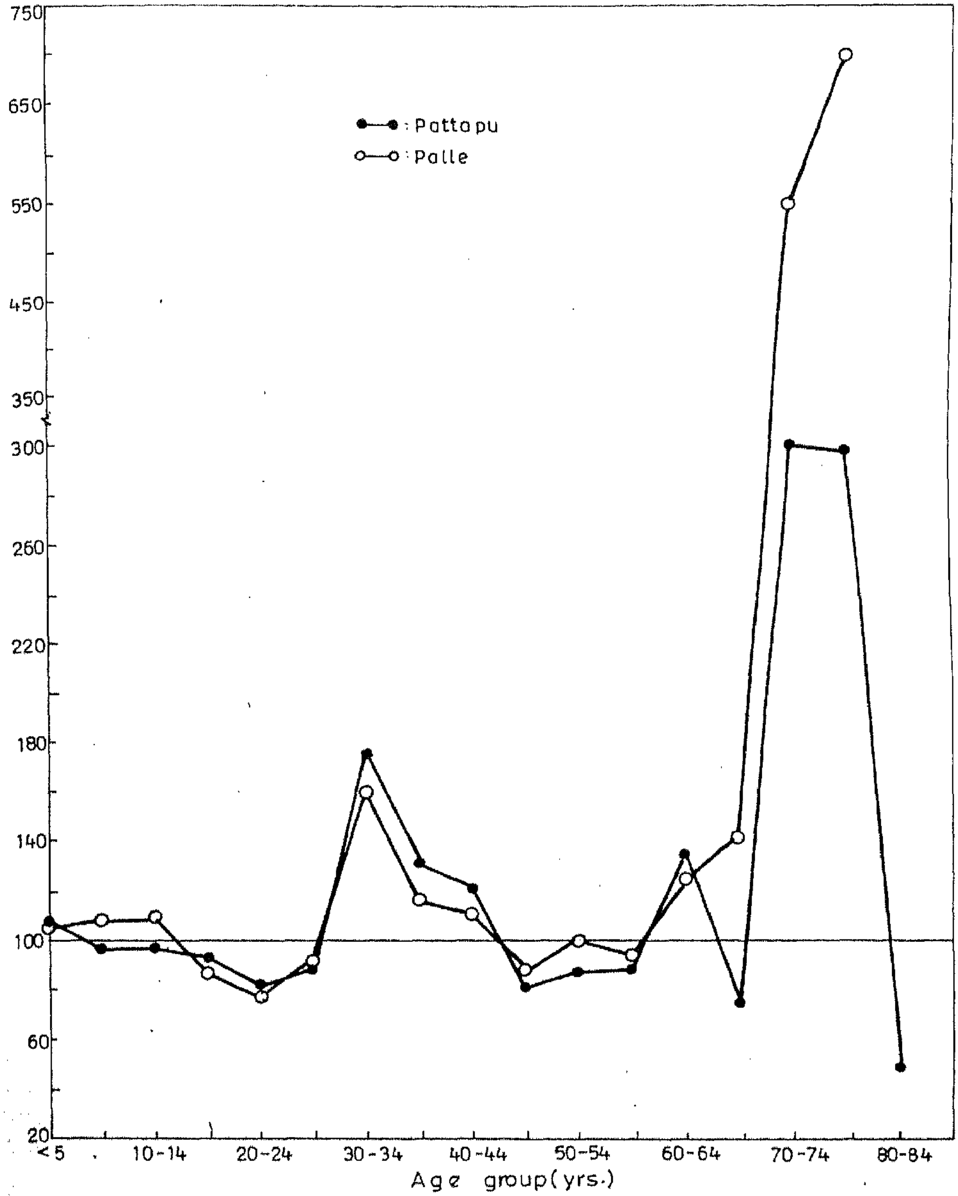


Fig. 8 : Sex Ratio (Males per 100 Females) by Age group among the Pattapu and Palle

mortality among the women of reproductive age. It is important to note that Palle are fond of children, marry earlier, worry more about traditional customs and cultural practices. Therefore, their women are expected to bear high number of pregnancies which increases the risk of maternal morbidity or mortality and indirectly lower down the resistance causing more proneness to diseases (Philippe, 1980) The same is also observed in different populations (Arabinda Basu, 1972; Anadipal, 1976, Ramesh 1979, Narahari 1982, Deepkumar 1985) where as in Pattapu reverse trend was observed due to less number of pregnancies when compared to Palle, decreases the risk of maternal morbidity or mortality.

4A.4 CHILD-WOMAN RATIO

Child women ratio is a simple relative measure of fertility. It will be useful to examine the current trend of fertility by observing the ratio of children born within the last four years to the number of women aged above 15 and below 45 years. Table 6 shows that child-women ratio is

TABLE-6

CHILD WOMEN RATIO AMONG THE PATTAPU AND PALLE

Population	No. of children (0-4 years)	Women in reproductive age group (15-44 yrs.)	Ratio
Pattapu	406	560	72.50
Palle	287	519	55.30

higher in Pattapu (72.50) than in Palle (55.30). However, these values indicate a low fertility ratio which is an effect of acceptance of family planning programme in the recent five years.

4A.5 AGING INDEX AND DEPENDENCY RATIO

The values of aging index and dependency ratio in Pattapu and Palle caste groups are given in table 7. Over 40 per cent of the total population belong to dependent children in both the castes. One half of the population contribute active population (15-59 years). Older males are slightly higher (5.89% in Pattapu and 6.24% in Palle) than older females. Lower the older age group population indicate the high level of fertility. Stockwell (1972) defined the index of aging as "the number of persons aged 65 and over per 100 children under 15 years of age" but in the present study 60 years and over has been taken as border line for aged dependents, because upto 59 years most of them are working and gave some financial support to the family. The aging index is more in males (13.70 in Pattapu and 15.09 in Palle) than in females (10.89 in Pattapu and 10.00 in Palle) reflecting the greater average age of males in these populations which may lead to higher paternal rather than maternal age.

TABLE-7

AGING INDEX AND DEPENDENCY RATIO AMONG PATTAPU AND PALLE

Population	Sex	Dependent children (0-15 years)		Active population (15-59 years)		Aged dependents (60 years and above)		Aging Index	CDR	ODR	TDR
		No	%	No	%	No	%				
Pattapu:											
	Male	613	43.02	728	51.09	84	5.89	13.70	84.20	11.54	95.74
	Female	606	43.88	709	51.34	66	4.78	10.89	85.47	9.31	94.78
	Total	1219	43.44	1437	51.21	150	5.35	12.31	84.83	10.44	95.27
Palle:											
	Male	497	41.35	630	52.41	75	6.24	15.09	78.89	11.90	90.79
	Female	460	40.32	635	55.65	46	4.03	10.00	72.44	7.24	79.68
	Total	957	40.85	1265	53.99	121	5.16	12.64	75.65	9.57	85.22

C.D.R. - Child Dependency Ratio   O.D.R. - Old Dependency Ratio

T.D.R. - Total Dependency Ratio

The dependency ratio is an important measure of age distribution, and a component of two categories (1) Child dependency ratio and (2) Old dependency ratio. A very high child dependency ratio and low the old dependency ratio are the characteristic feature of the population of the under developed countries, Rural populations and population with high growth rate. In the present study both Pattapu and Palle show a higher values of child dependency ratio (Pattapu: 84.83; Palle : 75-65) and lower values of old dependency ratio (Pattapu: 10.44; Palle: 9.57) relatively show that these populations incline towards potentially growing populations. The total dependency ratio indicate the 95 persons in Pattapu and 85 persons in Palle are economically inactive persons per 100 economically active persons in the population.

4A.6 BIO-EVENTS: (OR DEMOGRAPHIC ASPECTS)

The Pattapu and Palle caste groups have been compared for some of the demographic features like age at menarche, age at marriage among men and women, age difference between husband and wife, marital distance and age at menopause (Table-8) in order to evaluate the similarities and differences between the two endogamous groups.

The mean age at menarche is observed to be almost same in the Pattapu and Palle groups (13.75 years and 13.85 years

TABLE - 8

BIO-EVENTS COMPARISION BETWEEN PATTAPU AND PALLE

Bio-event	Pattapu	Palle	t value between castes
Age at Menarche (Yrs.)	13.75 ± 0.03	13.85 ± 0.03	2.358*
Age at marriage among men (Yrs.)			
Con. Mar.	22.79 ± 0.17	22.80 ± 0.19	0.039
Non-con. Mar.	23.47 ± 0.15	23.25 ± 0.18	0.940
Total	23.23 ± 0.11	23.06 ± 0.13	0.998
t value between con. and non-con.	2.996	1.718	
Age at marriage among women (Yrs.)			
Con. Mar.	16.74 ± 0.11	16.56 ± 0.12	1.104
Non-con. Mar.	17.00 ± 0.10	17.01 ± 0.10	0.071
Total	16.90 ± 0.08	16.82 ± 0.07	0.755
t value between con. and non-con.	1.745	2.885	
Age difference (Yrs.)			
Con. Mar.	5.99 ± 0.14	6.23 ± 0.18	1.053
Non-con. Mar.	6.53 ± 0.13	6.24 ± 0.16	1.408
Total	6.34 ± 0.10	6.24 ± 0.05	0.885
t value between con. and non-con.	2.827	0.041	
Marital Distance (Km)			
Con. Mar.	19.01 ± 1.65	15.32 ± 1.34	1.736
Non-con. Mar.	34.96 ± 1.87	31.49 ± 2.07	1.244
Total	29.33 ± 1.37	24.74 ± 1.37	2.370*
t value between con. and non-con.	6.395	6.557	
Age at Menopause (Yrs.)	41.58 ± 0.14	41.21 ± 0.18	1.623

Con.Mar - Consanguineous marriage

respectively) but the two groups show a statistically significant difference between their values of mean (t = 2.358) age at menarche.

In table-9 and Fig. 9 the data on age at menarche among the occupational caste girls have been reviewed with a view to examine whether there is any caste variation in the mean menarcheal age. Among the occupational caste groups, the higher mean age at menarche is shown in Brahmins (14.63) and Kshatriyas (14.63) studied by Chakravarti and Renuka (1970) and Subramanyam (1984) respectively, while the lowest age is shown in Madigas-I (12.97), a schedule caste population, studied by Rajasekhara Reddy (1981). The Pattapu (13.75) and Palle (13.85) women are very much closer to Vysyas (13.73) and Padmasalis (13.85) respectively. Thus, present populations fall within the occupational caste range of the menarcheal age. From this table it is clear that the onset of menarche decreases with the decrease of social status with few exceptions due to the non-vegetarianism of low status groups (Durgadevi, 1977 and Manjuvani, 1987).

The mean age at marriage of males in Pattapu and Palle are 23.23 years and 23.06 years respectively. The above values are significantly lower than the values of 16.90 years and 16.82 years as observed among females. The mean age at

TABLE-9

AGE AT MENARCHE AMONG THE OCCUPATIONAL CASTES IN ANDHRA PRADESH

Population	Occupation	No.of women	Menarcheal age Mean ± S.E.	Source
Brahmins	Priest hood	389	14.63 ± 0.08	Chakravarti and Renuka, 1970
Kshatriyas	Warriors	1506	14.63 ± 0.08	Subramanyam, 1984
Vysyas	Business	400	13.73 ± 0.07	Bhagyalakshmi, 1978
Pattusalis	Weavers	105	13.50 ± 0.14	Ravi kanaka seshu, 1980
Padmasalis I	Weavers	387	13.85 ± 0.08	Srinivasa Reddy, 1977
Padmasalis II	Weavers	441	13.41 ± 0.07	Balagopal, 1977
Ediga	Toddy tappers	400	13.48	Chandrasekhar 1989
PATTAPU	Fishing	638	13.75 ± 0.06	Present study
PALLE	Fishing	544	13.85 ± 0.03	Present study
Bestha	Fishing	196	14.00 ± 0.03	Surendranath Reddy, 1985
Kummaris	Pottery	45	13.02 ± 0.16	Mukherjee et al. 1977
Chakali	Washermen	554	13.12 ± 0.07	Subhashini, 1986
Upparas	Tank diggers	200	13.97 ± 0.04	Satyanarayana, 1983
Madigas-I	Tanning	675	12.97 ± 0.04	Rajasekhara Reddy, 1981
Madigas-II	Tanning	450	13.05 ± 0.05	Sankaraiah, 1983
Malas-I	Tanning	1108	13.04 ± 0.02	Chengal Reddy, 1979
Malas-II	Tanning	323	13.13	Chandrasekhar, 1989

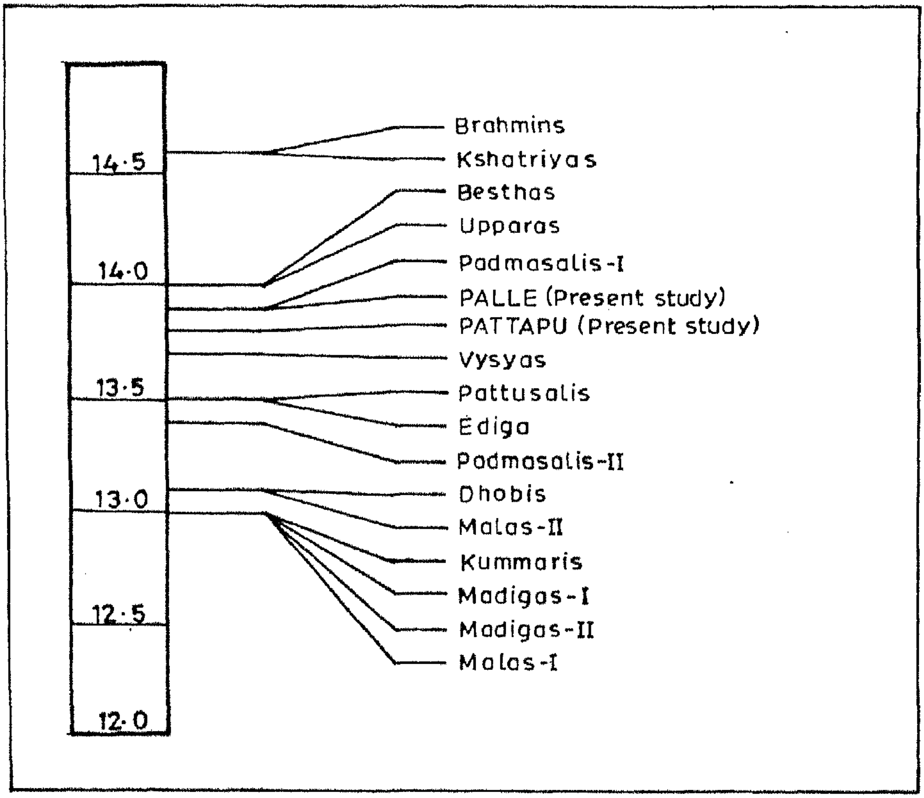


Fig. 9 :Gradient of Age at Menarche in some Occupational Castes

marriage of men in both consanguineous and nonconsanguineous groups are observed to be almost same in both the Pattapu (22.79 and 22.80 years) and Palle caste groups (23.47 and 23.25 years respectively).

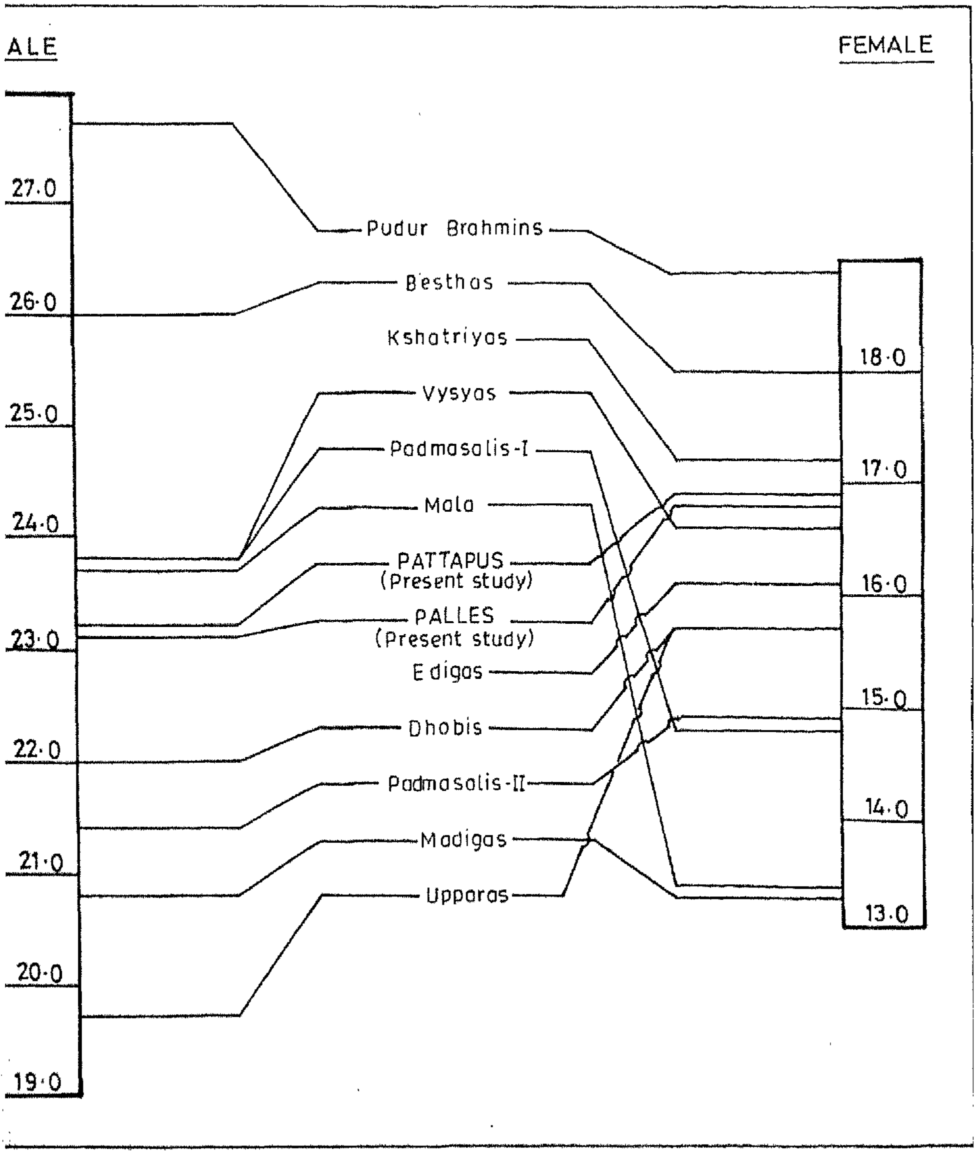
The mean age at marriage among women is also observed to be almost same in Pattapu (16.90 years) and Palle (16.82 years). The same trend is observed for consanguineously and non-consanguineously married women.

The mean marriage age among males and females of occupational caste groups in Andhra Pradesh including the present study is given in table-10 and Fig.10. It is observed from the table that the Pudur Brahmin caste shows higher age at marriage in both sexes (27.68 years in males and 18.87 years in females). On the other hand, Upparas show lower age at marriage in males (19.70 years), and Madiga (13.32 years) and Mala (13.35 years) show lower age at marriage in females. Thus, present populations fall within the occupational caste range in age at marriage. From this table, it is clear that the age at marriage is lower in low caste people than in high caste people due to illiteracy, poverty etc., among the low caste people.

TABLE 1?

AGE AT MARRIAGE IN MALES AND FEMALES AMONG SOME OCCUPATIONAL CASTES OF ANDHRA PRADESH

Population	Age at marriage (Yrs.) Males Sample size	Males Mean ± S.E	Females Sample size	Females Mean ± S.E	Source
Pudur Brahmins	107	27.68 ± 0.42	107	18.87 ± 0.83	Sivakumar Reddy, 1977
Kshatriyas	-	-	1506	17.20 ± 0.10	Subramanyam, 1984
Vysya	400	23.80 ± 0.22	400	16.58 ± 0.18	Bhagyalakshmi, 1978
Padmasalis-I	441	23.80 ± 0.11	441	14.83 ± 0.12	Balagopal, 1977
Padmasalis-II	362	21.41 ± 0.15	387	14.90 ± 0.12	Srinivasa Reddy, 1977
Ediga	-	-	400	16.06 ± 0.13	Chandrasekar, 1989
PATTAPU	638	23.23 ± 0.11	638	16.90 ± 0.08	Present study
PALLE	544	23.06 ± 0.13	544	16.82 ± 0.07	Present study
Bestha	196	25.97 ± 1.85	196	18.00 ± 0.09	Surendranath Reddy, 1985
Dhobis	554	21.95 ± 0.12	554	15.69 ± 0.11	Subhashini, 1986
Upparas	200	19.70 ± 0.12	200	15.68 ± 0.12	Satyanarayana, 1983
Madiga	1368	20.83 ± 0.06	1368	13.32 ± 0.06	Rajasekhar Reddy, 1985
Mala	747	23.66 ± 0.15	866	13.35 ± 0.10	Chengal Reddy, 1979



ig.10 :Gradient of Age at marriage in some Occupational Castes

The mean age difference between the spouses among Pattapus (6.34 years) and Palles (6.24 years) is observed to be almost similar. There is no significant difference observed for this character between the two castes in their consanguineous and non-consanguineous groups.

In the mean marital distance, Pattapus show a greater mean value than Palles in consanguineous (19.01 Km. and 15.32 Km. respectively), non-consanguineous (34.96 Km. and 31.49 Km respectively) and total (29.33 Km. and 24.74 km. respectively). But only total mean marital distance show a significant difference between two caste groups (t=2.37). The non-consanguineous groups of the two caste groups show higher value than the consanguineous group.

The values of mean marital distance among consanguineous and non-consanguineous groups of the present study are compared with those of the other caste groups of Andhra Pradesh studied earlier and given in table 11 and in Fig. 11. The mean marital distance in relations to consanguinity shows consistency with the usual trend observed in most of the earlier studies in Andhra Pradesh. The present populations do not deviate from the above tendency. The consanguineous couples show lower mean marital distance than their counterparts. However, total mean marital distance of present

TABLE-11

MEAN MARITAL DISTANCE OF CONSANGUINEOUS AND NON-CONSANGUINEOUS COUPLES AMONG THE CASTES IN ANDHRA PRADESH

Population	Consanguineous		Non-Consanguineous		Total		Source
	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.	
Kshatriyas	663	19.40 ± 1.11	843	43.10 ± 1.52	1506	32.70 ± 1.03	Subramanyam, 1984
Vysya	60	59.67 ± 7.18	340	91.16 ± 3.38	400	86.44 ± 3.12	Bhagyalakshmi, 1978
Reddies	187	6.18 ± 0.49	220	9.27 ± 0.55	407	7.85 ± 0.36	B.K.C.Reddy, 1977
Kammas	179	11.71 ± 0.96	216	14.41 ± 0.57	395	13.25 ± 0.65	Padmanabha Naidu, 1977
Palli Reddy	322	19.61 ± 0.89	390	23.47 ± 0.89	712	21.72 ± 0.64	Subhashini, 1981
Padmasali	277	10.18 ± 1.57	164	15.96 ± 1.47	441	12.33 ± 0.76	Balagopal, 1977
Ediga	60	19.42 ± 2.57	40	28.38 ± 3.39	100	23.31 ± 2.10	Srinivasulu et al. 1975
PATTAPU	225	19.01 ± 1.65	413	34.96 ± 1.87	638	29.33 ± 1.37	Present study
PALLE	227	15.32 ± 1.34	317	31.49 ± 2.07	544	24.74 ± 1.37	Present study
Bestha	64	14.30 ± 1.96	132	18.59 ± 0.97	196	17.75 ± 0.67	Surendranath Reddy, 1985
Vadde	674	7.07 ± 0.34	1404	7.77 ± 0.23	2238	7.61 ± 0.19	Mohan Reddy, 1983
Palle	40	30.80 ± 3.22	79	28.60 ± 1.99	121	29.48 ± 1.68	Mohan Reddy, 1983
Uppara	28	9.34 ± 1.51	172	23.43 ± 1.85	200	21.13 ± 1.07	Satyanarayana, 1983
Madiga	270	18.59 ± 0.80	405	24.74 ± 0.71	675	22.28 ± 0.64	Rajasekhar Reddy, 1981
Mala	321	7.20 ± 0.45	564	11.02 ± 0.49	885	9.65 ± 0.36	Chengal Reddy, 1979

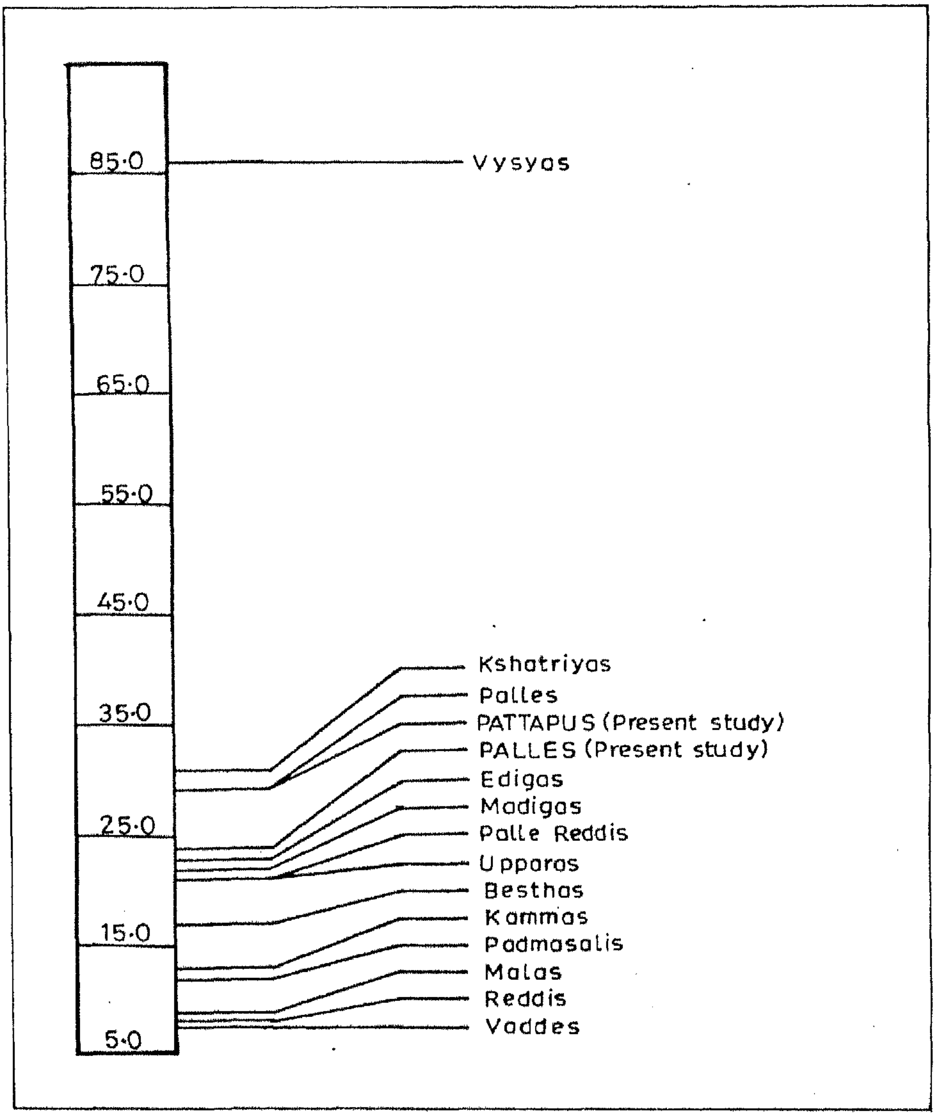


Fig.11 : Gradient of Mean Marital Distance in caste groups of Andhra Pradesh

populations fall within the range of the other castes in Andhra Pradesh.

The women of Pattapu and Palle caste groups tend to show more or less same mean age at menopause (41.58 years) and 41.21 years respectively) and fail to reveal any significant variation between them for this demographic aspect (Table-8).

The mean menopause age among the castes of the Andhra Pradesh including present study is given in Table 11-A and Fig. 12. It is observed from the table that Pattapu and Palle show early menopause age when compared to other caste of Andhra Pradesh. It may be due to the malnutrition and lack of medical facilities which are caused by low economic conditions (McMohan and Worcester, 1966).

4A.7 PATTERN AND PREVALENCE OF CONSANGUINEOUS MARRIAGES

The pattern and prevalence of consanguinity among the Pattapu and the Palle caste groups is shown in Table 12 and Fig. 13. It is observed from this table that both the groups show a moderate frequency of consanguineous marriages but Palle (41.73%) shows higher frequency than Pattapu (35.27%). Higher frequency of first (cross) cousin marriages are ob-

TABLE-11A

MEAN AGE AT MENOPAUSE AMONG THE CASTES IN ANDHRA PRADESH

Population	No.of women	Menopause age Mean + S.E.	Source
Pudur Brahmins	28	47.46 ± 0.68	Sivakumar Reddy, 1977
Vysyas	78	45.87 ± 0.39	Bhagyalakshmi, 1978
Panta Kapus	22	46.77 ± 0.65	Sivakumar Reddy, 1977
Balijas	251	48.16 ± 0.14	Gunasundaramma, 1980
PATTAPU	203	41.58 ± 0.14	Present study
PALLE	188	41.21 ± 0.18	Present study
Chakalis	188	45.55 ± 0.16	Subhashini, 1985
Malas	228	48.98 ± 0.08	Chengal Reddy, 1979
Madigas	96	46.63 ± 0.27	Rajasekhar Reddy, 1981

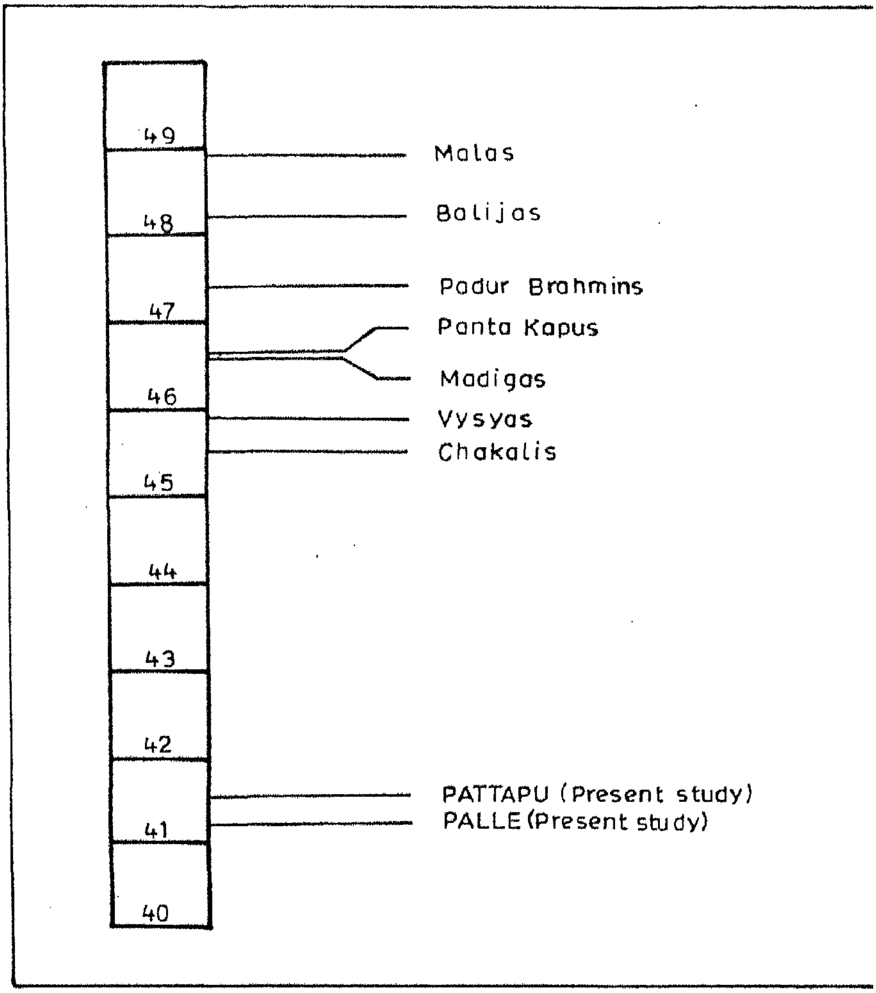


Fig. 12 : Gradient of mean age at menopause in caste groups of Andhra Pradesh

TABLE-12

DISTRIBUTION OF CONSANGUINEOUS MARRIAGES AMONG PATTAPU AND PALLE CASTE GROUPS

Type of marriage	Population			
	Pattapu		Palle	
	Number	%	Number	%
Non-Consanguineous	413	64.73	317	58.25
Consanguineous	225	35.27	227	41.73
Uncle-niece	31	4.86	48	8.82
First Cross Cousin	135	21.16	126	23.16
Mother's Brother's daughter	107	16.77	77	14.15
Father's Sister's daughter	28	4.39	49	9.01
First Cousin once removed	25	3.92	29	5.33
Second Cousin	34	5.33	24	4.41
Total	638	100.00	544	100.00

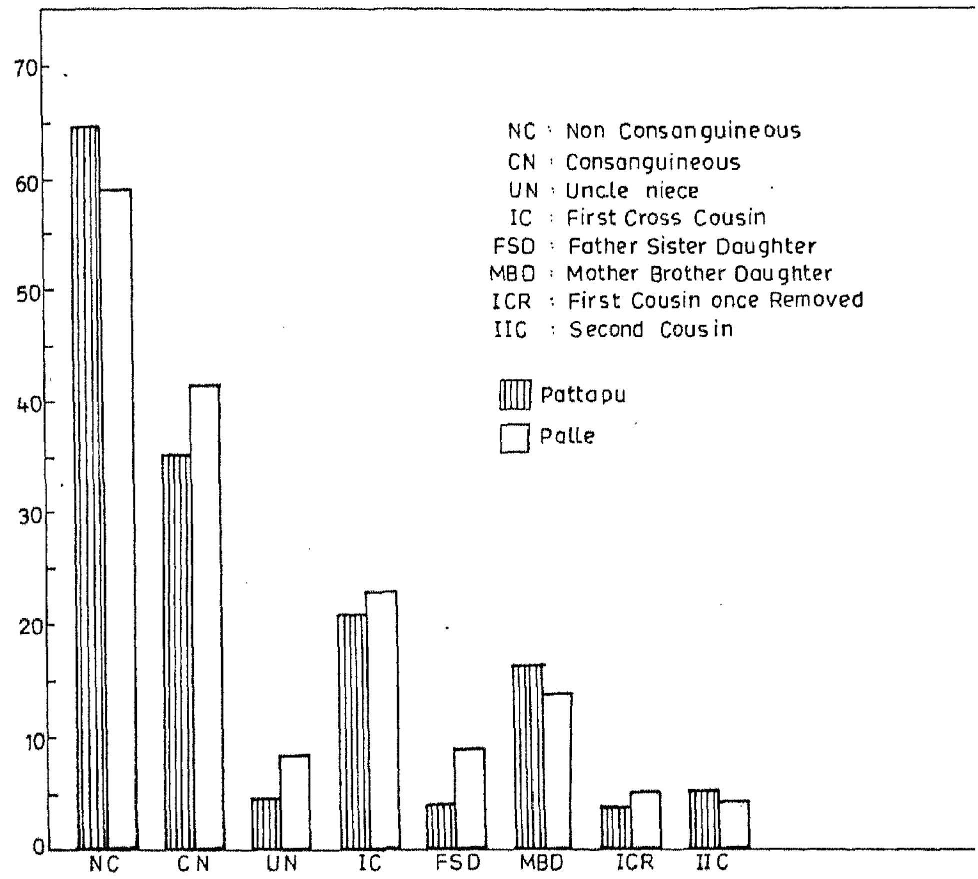


Fig.13: Frequency distribution of Non-Consanguineous (N C) and Consanguineous (C N) marriages

served in both Pattapu (21.16%) and Palle (23.16) than other consanguineous marriage types. Among first cousin marriages in both groups, matrilateral cross-cousin marriages (16.77% in Pattapu and 14.15% in Palle) are preferred more frequently than the patrilateral cross-cousin marriages (4.39% in Pattapu and 9.01% in Palle), a general feature found in many of the South Indian Populations. (Sanghvi, 1966; Reid, 1973; Roy Choudhury, 1976; Narahari, 1982; Chengal Reddy, 1983; Deepkumar, 1985 and Papa Rao, 1989). This preferential trend towards matrilateral cross cousin marriage type may be due to the early marriage of girls (Reid, 1973) which depends upon the cultural traditions (Rao and Inbaraj, 1977) and South Indian Population having Dravidian kinship organisation (Sanghvi, 1966 and Roy Choudhury 1976a & b). Since Pattapu and Palle females marry and reproduce at an early age and their children are on the average older than their brother's children and it is therefore more likely that a boy can find a girl of the appropriate age among his mother's brother's daughters than among his father's sister's daughters. However, the two groups show the practice of uncle-niece marriages with 4.86% in Pattapu being less than Palle of 8.82%. According to Sanghvi (1966), uncle-niece marriage is one of the important cultural practice in coastal Andhra Pradesh where the present study areais also located. The other distant type of consanguineous

marriages like first cousin once removed (Pattapu: 3.92% and Palle: 5.33%) and second cousins (Pattapu : 5.33% and Palle: 4.41%) occur with low frequencies.

4A.8 OCCURENCE OF CONSANGUINEOUS MARRIAGES AMONG THE VILLAGES

The frequency of different types of consanguineous marriages in different villages (representing the Pattapu and Palle sample of study) are presented in Table-13. The total frequency of consanguineous marriages vary from 33.10% in Mypadu Pattapupalem to 39.47% in Kothasathram of Pattapu where as in Palle it varies from 44.16% in Gangapatnam and 37.93% in Ramudupalem. The villages of Pattapu exhibits decreasing trend of consanguinity from North to South but in case of Palle reverse trend of consanguinity observed from North to South, since high prevalence of consanguineous marriages coupled with low density of population (Ramesh, 1979). Generally, the present populations, Pattapus increased in number from North to South but in Palle reverse trend is observed.

The closest type of consanguineous marriage was observed between uncle and niece. Such marriages occur with highest frequency in Utukur (7.37%) to Mypadu (4.14%) in Pattapu, whereas in Palle it varies from 5.80% (Thummalapenta) to 14.29%

TABLE 13

PERCENTAGE OF FREQUENCY OF CONSANGUINEOUS MARRIAGES IN DIFFERENT VILLAGES OF THE PATTAPU AND PALLE

Population	Sl. No.	Name of the village	No. of marriages	Type of Consanguineous marriages: Uncle niece	First cross cousin: Patrilateral	First cross cousin: Matrilateral	First cousin once removed	Second cousin	Total	Non consanguineous
Pattapu:	1	Mypadu	145	6 (4.14)	4 (2.76)	29 (20.00)	2 (1.38)	7 (4.83)	48 (33.10)	97 (66.90)
	2	Utukur	95	7 (7.37)	2 (2.11)	15 (15.79)	4 (4.21)	4 (4.21)	32 (33.68)	63 (66.32)
	3	Venkteswara-puram	141	7 (4.96)	4 (2.84)	23 (16.31)	8 (5.67)	6 (4.26)	48 (34.04)	93 (65.96)
	4	Thummala-penta	143	6 (4.20)	9 (6.29)	20 (14.00)	8 (5.59)	9 (6.29)	52 (36.36)	91 (63.64)
	5	Kotha Sathram	114	5 (4.39)	9 (7.89)	20 (17.54)	3 (2.63)	8 (7.02)	45 (39.47)	69 (60.53)
		Total	638	31 (4.86)	28 (4.39)	107 (16.77)	25 (3.92)	34 (5.33)	225 (35.27)	413 (64.73)
Palle:	1	Gangapatnam	77	11 (14.29)	3 (3.90)	13 (16.88)	3 (3.90)	4 (5.19)	34 (44.16)	43 (55.84)
	2	Kudithipalem	79	8 (10.13)	10 (12.66)	8 (10.13)	7 (8.86)	1 (1.27)	34 (43.04)	45 (56.96)
	3	Utukur	102	9 (8.82)	12 (11.76)	13 (12.75)	4 (3.92)	5 (4.90)	43 (42.16)	59 (57.84)
	4	Vattur	112	7 (6.25)	13 (11.61)	19 (16.96)	4 (3.57)	4 (3.57)	47 (41.96)	65 (58.04)
	5	Thummala-penta	69	4 (5.80)	6 (8.70)	10 (14.50)	3 (4.34)	6 (8.70)	29 (42.03)	40 (57.97)
	6	Srirampuram	47	5 (10.64)	3 (6.38)	4 (8.51)	3 (6.38)	3 (6.38)	18 (38.30)	29 (61.70)
	7	Ramudupalem	58	4 (6.90)	2 (3.45)	10 (17.24)	5 (8.62)	1 (1.72)	22 (37.93)	36 (62.07)
		Total	544	48 (8.82)	49 (9.01)	77 (14.15)	29 (5.33)	24 (4.41)	227 (41.73)	317 (58.27)

Figures in parentheses are percentages

in Gangapatnam. Of the first cross cousin marriages, patrilateral cross cousin marriages vary from 2.11% in Utukur to 7.89% in Kothasathram and from 3.45% in Ramudupalem to 12.66% in Kudithipalem of Pattapu and Palle caste groups respectively. The frequency of matrilateral cross cousin marriages also varies and it ranges from 14.00% in Thummalapenta to 20.00% in Mypadu of Pattapu and from 8.51% in Srirampuram to 17.24% in Ramudupalem of Palle. While the frequency of first cousin once removed marriages range from 1.38% in Mypadu to 5.67% in Venkateswarapuram of Pattapu and from 3.90% in Gangapatnam to 8.86% of Kudithipalem of Palle respectively. Second cousin marriages vary between 4.21% in Utukur to 7.02% in Kothasathram of Pattapu and from 1.27% in Kudithipalem to 8.70% in Thummalapenta of Palle respectively. There is no consistent north to South trend by degree of consanguineous types in both caste groups.

4A.9 INBREEDING COEFFICIENT

The village-wise and total Pattapu and Palle caste group-wise distribution of autosomal and sex linked inbreeding coefficients along with their standard errors are given in the table-14. The mean inbreeding coefficient for autosomal genes is lower in Pattapu group (0.021) than in Palle group (0.028). In fact, the proportion of closest type of

TABLE-14

VILLAGE WISE DISTRIBUTION OF MEAN AUTOSOMAL (α) AND SEX LINKED (α_1) INBREEDING COEFFICIENTS AMONG PATTAPU AND PALLE

Population	Sl. No.	Name of the village	No. of marriages	$\alpha \pm$ S.E.	$\alpha_1 \pm$ S.E.
Pattapu:	1	Mypadu Pattapupalem	145	0.021 ± 0.0028	0.032 ± 0.0045
	2	Utukur	95	0.022 ± 0.0100	0.033 ± 0.0056
	3	Venkateswarapuram	141	0.021 ± 0.0029	0.029 ± 0.0044
	4	Thummalapenta	143	0.021 ± 0.0027	0.025 ± 0.0058
	5	Kotha Sathram	114	0.023 ± 0.0032	0.029 ± 0.0049
		Total	638	0.021 ± 0.0014	0.029 ± 0.0022
Palle:	1	Gangapatnam	77	0.033 ± 0.0051	0.045 ± 0.0079
	2	Kudithipalem	79	0.030 ± 0.0053	0.028 ± 0.0058
	3	Utukur	102	0.028 ± 0.0040	0.028 ± 0.0052
	4	Vattur	112	0.027 ± 0.0035	0.029 ± 0.0050
	5	Thummala Penta	69	0.024 ± 0.0043	0.031 ± 0.0063
	6	Srirampuram	47	0.026 ± 0.0060	0.026 ± 0.0074
	7	Ramudupalem	58	0.025 ± 0,0049	0.032 ± 0.0071
		Total	544	0.028 ± 0.0017	0.031 ± 0.0023

marriages such as uncle-niece and patrilateral cross cousin marriages in Pattapu are substantially lower than those of Palle. On the other hand, the mean inbreeding coefficient for sex linked genes is slightly higher in Palle group (0.031) than in Pattapu group (0.029). The occurence of higher value of mean sex linked inbreeding coefficient among Palle is attributed to the occurrence of relatively higher incidence of uncle-niece marriages besides matrilateral cross cousin marriages.

The inbreeding coefficient for autosomal genes varies from 0.021 in Mypadu, Venkateswarapuram and Thummalapenta to 0.023 in Kotha Sathram of Pattapu group and from 0.024 in Thummalapenta to 0.033 in Gangapatnam of Palle group. The sex linked inbreeding coefficient on the other hand vary from 0.025 in Thummalapenta to 0.033 in Utukur and from 0.0026 in Srirampuram to 0.045 in Gangapatnam of Pattapu and Palle groups respectively. The relative incidence of uncle-niece and first cousin marriages besides other consanguineous marriages contribute for the variation in the autosomal inbreeding coefficient, while uncle-niece and matrilateral cross cousin marriages mainly contributes to the difference in sex linked inbreeding coefficients in different villages.

4A.10 TEMPORAL TREND OF CONSANGUINITY

The percentage frequency distribution of consanguineous marriages in relation to year of marriage of spouses among Pattapu and Palle is presented in Table-15 and in Fig. 14. It is observed from the table that a gradual decline with time (from/before 1939 to/after 1980) in the frequency of total consanguineous marriages can be seen in both the caste groups (44.83% to 31.21% and 61.11% to 33.86% in Pattapu and Palle, respectively). This decreasing difference is more in Palle than in Pattapu. The analysis with in consanguineous marriages showed no specific trend in both caste groups. The results reveal the trend of decrease of consanguineous marriages over years in both castes. Similar trends have also been observed in some earlier studies among Indian populations (Sanghvi et al. 1956; Undevia and Balakrishnan, 1978; Basu, 1978; Chengal Reddy 1983a; Yaseen Saheb, 1985; Papa Rao, 1989). The main reasons for such decline are found to be conscious avoidance of such marriages, changes in population structure, modern transport system, urbanisation and other socio-cultural factors.

4A.11 PREDICTION OF CONSANGUINITY WITH SOCIO-ECONOMIC, DEMOGRAPHIC AND BIOLOGICAL VARIABLES

To explain the individual influence of independent variable on the consanguinity, and also to know the combined

TABLE-15

PERCENTAGE OF MARRIAGE BY TYPE OF CONSANGUINITY, YEAR OF MARRIAGE AMONG PATTAPU AND PALLE

Type of Consanguinity	Year of Marriage											
	<1939		1940-1949		1950-1959		1960-1969		1970-1979		1980<	
	Pattapu	Palle	Pattapu	Palle	Pattapu	Palle	Pattapu	Palle	Pattapu	Palle	Pattapu	Palle
Uncle-niece	3.45 (1)	11.11 (2)	4.69 (3)	8.93 (5)	7.87 (7)	18.42 (14)	6.86 (7)	6.60 (7)	4.06 (8)	4.97 (8)	3.18 (5)	9.45 (12)
First Cross cousin	27.59 (8)	38.89 (9)	26.57 (17)	28.57 (16)	22.47 (20)	19.73 (15)	22.55 (23)	28.30 (30)	20.30 (40)	23.60 (38)	17.20 (27)	15.75 (20)
First Cousin once removed	6.90 (2)	11.11 (2)	4.69 (3)	10.71 (6)	6.74 (6)	2.63 (2)	2.94 (3)	7.55 (8)	3.55 (7)	3.73 (6)	2.55 (4)	3.94 (5)
Second Cousin	6.90 (2)	-	6.25 (4)	5.36 (3)	3.37 (3)	6.58 (5)	1.96 (2)	1.89 (2)	5.08 (10)	4.97 (8)	8.28 (13)	4.72 (6)
Total Consan-guinity	44.83 (13)	61.11 (11)	42.19 (27)	53.57 (30)	40.45 (36)	47.37 (36)	34.31 (35)	44.34 (47)	32.99 (65)	37.27 (60)	31.21 (49)	33.86 (43)
Non-Consan-guinity	55.17 (16)	38.89 (7)	5.78 (37)	46.43 (26)	59.55 (53)	52.63 (40)	65.69 (67)	55.66 (59)	67.01 (132)	62.73 (101)	68.79 (108)	66.14 (84)
Total number of marriages	29	18	64	56	89	76	102	106	197	161	157	127

Figures in parentheses are Absolute Numbers

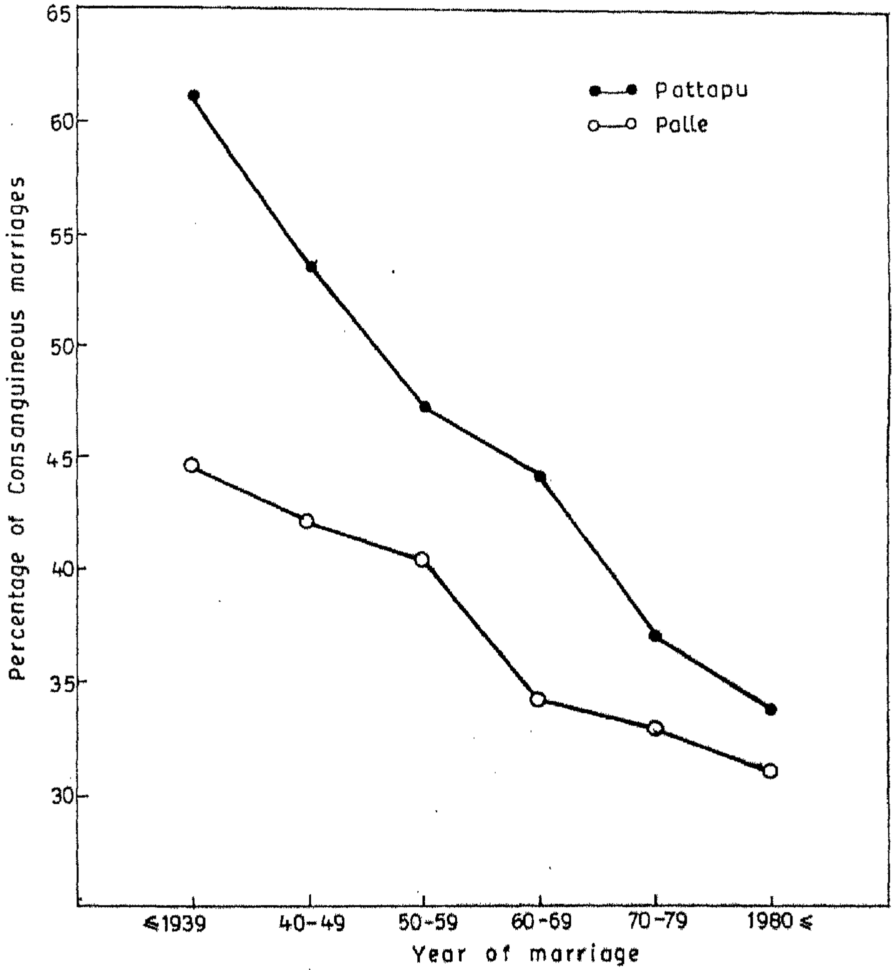


Fig.14 :Temporal Trend of Consangunity in Pattapu and Palle

effect of several factors, a stepwise multiple regression was employed. The results are given in table-16. In this analysis, degree of consanguinity was taken as dependent variable and the socio-economic, demographic and biological variables have been considered as independent variables. These independent variables were entered one after another according to their tolerance value. The sequence of these independent variables were presented in same order as disclosed in the computer output.

The results indicated that these independent variables had different implications in Pattapu and Palle caste groups. Coefficient of marital distance in Pattapu (0.248) and Palle (0.281) were positive and significant at 1 per cent probability level. These values indicate that degree of consanguinity increases by 0.248 units in Pattapu and 0.280 units in Palle for every unit increase in marital distance. In Palle coefficient of family planning was positive and significant at 1 per cent probability level indicates the degree of consanguinity that increases by 0.493 units from vasectomy to tubectomy. But in case of Pattapu coefficient of family planning was negative and insignificant. The coefficients of all the remaining independent variables were positive except pregnancies of Pattapu and income and pregnancies of Palle which show negative and insignificant values. So,

TABLE-16

STEP-WISE REGRESSION OF CONSANGUINITY

	Independent Variable	Coeffi-cient	S.E.	t-Value	r	R^2	% Individual contribution of variable
Pattapu:	Marital distance	.24810	.04156	5.9691*	.230	0.0606	0.0460
	Duration of effective married life	.13225	.08784	1.5056	.051		0.0043
	Family planning	-.16732	.14778	1.1322	-.039		0.0017
	Pregnancies	-.22265	.29120	.7646	.016		0.0037
	Women age at marriage	.03722	.05476	.6797	.040		0.0011
	Live births	.18031	.2898	.6222	.020		0.0037
	Income	.02952	.12664	.2330	.015		0.0001
Palle:	Marital distance	.28056	.18425	6.1617*	.257	0.0885	0.0659
	Family planning	.49344	.18425	2.6781*	.103		0.0114
	Income	-.24258	.13920	1.7426	-.071		0.0053
	Age at puberty	.23254	.14734	1.5783	.063		0.0041
	Live births	.05715	.14434	0.3960	.018		0.0011
	Women age at marriage	.02080	.04801	0.4334	.054		0.0010
	Pregnancies	-.02584	.15075	0.1715	.014		0.00037

* Significant at 1 per cent probability level

these independent variables do not show a significant effect on consanguinity. However, all independent variables together had explained low per cent, i.e., 6.06 per cent and 8.85 per cent, of variation in consanguinity of Pattapu and Palle respectively. Out of these, only marital distance was found to be prominant predictor, individually contributing 4.60 per cent in Pattapu and 6.59 per cent in Palle of the total variance. Remaining independent variables show negligible variation of consanguinity in both caste groups.

The comparison of present data with those of the other occupational caste population of Andhra Pradesh on similar information strictly speaking may not parallel because (1) they differ in the period of study, 2) there can be overlapping by way of repeated sampling from the same locality, religion and community or caste and 3) there is a variation in methodology adopted during the collection of data. It is beyond the scope of present thesis to detail the reasons. However, an attempt is made to assess the trends of consanguinity and level of inbreeding among the occupational caste populations of Andhra Pradesh. For this a total of 22 caste populations including the present study are listed in table 17 and in fig. 15.

TABLE-17

CONSANGUINITY AND LEVEL OF INBREEDING AMONG THE OCCUPATIONAL CASTES IN ANDHRA PRADESH

Population	Occupation	No. of marriages	Consanguinity %	F_A	Source
Brahmins	Priest hood	104	19.20	0.015	Sanghvi, 1966
Brahmins	Priest hood	125	24.80	0.017	Umarani, 1982
Kshatriya	Warrior	1506	44.00	0.028	Subramanyam, 1984
Vysya	Business	400	15.00	0.011	Bhagyalakshmi, 1978
Devanga	Weavers	297	40.74	0.034	Govinda Reddy, 1981
Pattusalis	Weavers	265	48.70	0.030	Papa Rao and Mukherjee, 1975
Ediga	Toddy tappers	400	47.50	0.033	Chandrasekhar, 1989
Gollas	Cattle herders	1667	43.19	0.031	Papa Rao, 1989
Shepher·ed	Cattle herders	482	51.87	0.038	Sanghvi, 1966
PATTAPU	Fishing	638	35.27	0.021	Present study
PALLE	Fishing	544	41.73	0.028	Present study
Vadde	Fishing	2241	32.62	0.019	Mohan Reddy, 1983
Fishermen	Fishing	308	56.82	0.047	Sanghvi, 1966
Palle	Fishing	125	32.80	0.021	Mohan Reddy, 1983
Jalari	Fishing	102	47.06	0.038	Veerraju, 1973
Kummaris	Pottery	72	36.10	0.031	Mukherjee et a. 1977
Chakalis	Washing	514	43.14	0.0357	Subhashini, 1985
Odde	Well digging	405	45.19	0.046	Narasimha Reddy, 1982
Mangali	Barber	99	77.77	0.047	Pamduranga Rao, 1980
Madiga	Tanning	1358	48.17	0.038	Rajasekhara Reddy, 1980
Mala	Tanning	885	36.27	0.024	Chengal Reddy, 1983a
Mala	Tanning	324	43.21	0.037	Govinda Reddy, 1981

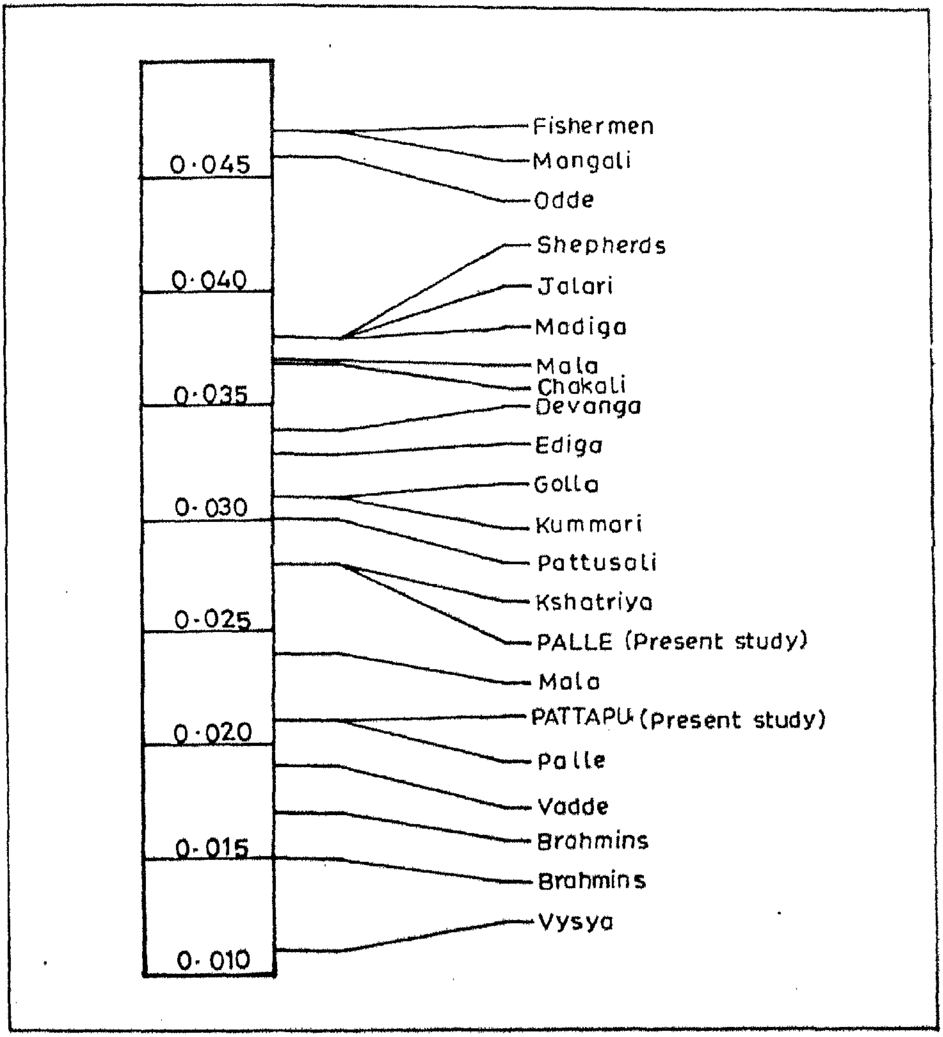


Fig. 15 : Gradient of Inbreeding Coefficient in Occupational Castes

It is observed from the table-17, that the fishermen and Mangali castes are found to be highly inbred groups. Out of the total marriages in the fishermen and Mangali 56.82 per cent and 77.77 per cent are found to be consanguineous respectively showing a value of inbreeding coefficient of 0.047. This has resulted due to the high frequency of closest types of consanguineous marriages such as uncle-niece and first cross cousin marriages. On the other hand, the vysya shows low level of consanguinity (15%) and inbreeding coefficient (0.011). This may be due to the imporance given by them for dowry rather than blood relationship because of the importance of money in their occupation (business). The Pattapus and Palles of the present study are showing 35.27 per cent and 41.73 per cent of consanguineous marriages with 0.021 and 0.028 inbreeding coefficients respectively. This fits well in the middle of the range observed for the occupational caste populations of Andhra Pradesh. From this table it is clear that the prevalence of consanguinity and the level of inbreeding decreases with the increase of social status with few exceptions.

4A.12 ENDOGAMY AND MEAN MARITAL DISTANCE (M.M.D)

Mean marital distance and Endogamy in relation to different degrees of consanguinity among Pattapu and Palle

are presented in Table-18. Out of 638 marriages of Pattapu 24.76 per cent of spouses married within the same village, whereas in Palle out of 544 marriages 36.58 per cent of spouses married in the same village. The difference between the two castes is observed to be statistically significant (Z= 4.412)at 1 per cent level of probability . A marked difference can be seen in the incidence of village endogamy between Pattapu and Palle in consanguineous (36.44% and 46.70% respectively) and in non-consanguineous (18.40% and 29.34% respectively) couples. There is no significant difference observed between the two castes. There is no consistent trend with the increasing degree of relatedness. This indicate that village endogamy does not depend on the degree of consanguinity.

The Mean Marital Distance (M.M.D) with respect to different degrees of consanguinity (Table-18) does not show a trend of either increase or decrease with increasing degree of relatedness except that the M.M.D of uncle niece and Mother's brother's daughter marriages is considerably smaller than the other degree of relatedness and as well as with non-consanguineous couples. However, non-consanguineous couples show double the M.M.D than that among consanguineous one. However significant (t values= Pattapu-6.396; Palle-6.557) difference of M.M.D between consanguineous and non-consanguineous couples

TABLE-18

MEAN MARITAL DISTANCE (MMD) AND PERCENTAGE OF VILLAGE ENDOGAMY BY CONSANGUINITY AMONG PATTAPU AND PALLE

Consanguinity type	PATTAPU			PALLE		
	No.	MMD(Km) ± S.E.	% village endogamy	No.	MMD(Km) ± S.E.	% village endogamy
Non-Consanguineous	413	34.96 ± 1.87	18.40	317	31.49 ± 2.07	29.34
Consanguineous	225	19.01 ± 1.65	36.44	227	15.32 ± 1.34	46.70
Uncle-niece	31	18.07 ± 4.39	51.61	48	7.52 ± 2.12	62.50
First Cross Cousin	135	19.45 ± 2.32	36.30	126	15.94 ± 1.77	43.65
Mother's Brother's daughter	107	17.90 ± 2.21	38.32	77	13.64 ± 2.04	45.05
Father's Sister's daughter	28	25.39 ± 7.27	28.57	49	19.55 ± 3.17	36.73
First Cousin once removed	25	15.36 ± 3.03	32.00	29	23.21 ± 4.69	37.93
Second Cousin	34	20.82 ± 3.75	26.47	24	18.13 ± 3.71	41.67
Total	638	29.33 ± 1.37	24.76	544	24.74 ± 1.37	36.58

have been observed at 1 per cent level of probability. There is significant (t=2.369) difference between Pattapu and Palle with regard to M.M.D at 5 per cent level of probability.

4A.13 MEAN MARITAL DISTANCE (M.M.D) AND VILLAGE ENDOGAMY VILLAGE-WISE

Mean marital distance and percentage of village endogamy in different villages of Pattapu and Palle caste groups are presented in table-19 and 20 respectively. In the Pattapu M.M.D varies from 26.48 km. in Kotha sathram to 33.04 km. in Mypadu and village endogamy varies from 22.76% in Mypadu to 27.19% in Kothasathram. This result show the increasing trend in M.M.D from North i.e., Kothasathram village to South i.e., Mypadu village where as in village endogamy concerned the trend is reversed i.e., decreasing from north to South villages. This trend may give some moral support to, consanguinity decreasing from north to south.

When the Palle caste group is considered the M.M.D varies from 20.31 km. in Ramudupalem to 30.11 km. in Gangapatnam and village endogamy varies from 27.59% in Ramudupalem to 42.86% in Gangapatnam. This result shows the increasing trend in M.M.D and village endogamy from north i.e., Ramudu-

TABLE-19

VILLAGEWISE MEAN MARITAL DISTANCE (M.M.D.) AND PERCENTAGE OF VILLAGE ENDOGAMY IN PATTAPU

Name of the village	No. of families	M.M.D. $\pm$ S.E. in Km	% Village endogamy
Mypadu Pattapupalem	145	33.04 $\pm$ 2.73	22.76
Utukur	95	29.66 $\pm$ 3.68	23.16
Venkateswarapuram	141	28.62 $\pm$ 3.31	24.82
Thummalapenta	143	28.36 $\pm$ 3.20	25.87
Kotha Sathram	114	26.48 $\pm$ 2.20	27.19

TABLE-20

VILLAGEWISE MEAN MARITAL DISTANCE (M.M.D.) AND PERCENTAGE OF VILLAGE ENDOGAMY IN PALLE

Name of the village	No. of families	M.M.D. $\pm$ S.E. in Km	% village endogamy
Gangapatnam	77	30.11 $\pm$ 5.27	42.86
Kudithipalem	79	27.14 $\pm$ 3.34	40.51
Utukur	102	25.49 $\pm$ 3.46	37.25
Vattur	112	24.29 $\pm$ 2.69	36.61
Thummalapenta	69	24.04 $\pm$ 3.89	34.78
Srirampuram	47	22.94 $\pm$ 3.41	31.91
Ramudupalem	58	20.31 $\pm$ 2.76	27.59

palem village to South i.e., Gangapatnam village. Due to the higher incidence of uncle-niece and Father's sister's daughter marriage the author did not find expected trend i.e., increasing trend in M.M.D from North to South. However, increasing trend of village endogamy from North to South may give some moral support to consanguinity increment from North to South.

The distribution of consanguinity and inbreeding (autosomal) coefficient by marital distance in Pattapu and Palle groups is given in table-21. In figure 16, the consanguinity and marital distance in Pattapu and Palle are shown. The marital distance has to be accounted for and divided into different categories while in the latter type it can be stated as nil or zero. In the 544 (Palle) and 638 (Pattapu) marriages, majority belong to village exogamous unions in Palle (63.42%) and in Pattapu (75.24%). The coefficient of inbreeding values for endogamous unions are 0.0345, 0.0386 in Pattapu and Palle respectively and for exogamous unions are 0.016 in Pattapu and 0.019 in Palle. Further, the frequency of consanguineous marriages and coefficient of inbreeding are observed to be decreasing with marital distance in both castes with few exceptions for inbreeding coefficient value in Palle caste. The frequency of consan-

TABLE-21

MARITAL DISTANCE, CONSANGUINITY AND CO-EFFICIENT OF INBREEDING (α) AMONG PATTAPU AND PALLE

Marital Distance (Km.)	Pattapu						Palle					
	Total marriages (N)	Con.		Non-Con.		$\alpha \pm$ S.E.	Total marriages (N)	Con.		Non-Con.		$\alpha \pm$ S.E.
		n	%	n	%			n	%	n	%	
0	158	82	51.90	76	48.10	0.035 ± 0.0033	199	106	53.27	93	46.73	0.039 ± 0.0032
1 - 10	85	35	41.18	50	58.82	0.022 ± 0.0034	55	25	45.45	30	54.55	0.034 ± 0.0060
11 - 20	82	28	34.15	54	65.85	0.017 ± 0.0032	76	33	43.42	43	56.58	0.028 ± 0.0043
21 - 30	75	24	32.00	51	68.00	0.017 ± 0.0035	45	17	37.78	28	62.22	0.023 ± 0.0055
31 - 40	85	25	29.40	60	70.59	0.019 ± 0.0037	48	17	35.42	31	64.58	0.018 ± 0.0042
41 - 50	61	16	26.23	45	73.77	0.018 ± 0.0044	47	16	34.04	31	65.96	0.018 ± 0.0044
51 - 60	23	5	21.74	18	78.26	0.013 ± 0.0064	20	5	25.00	15	75.00	0.013 ± 0.0053
61 - 70	24	4	16.67	20	83.33	0.005 ± 0.0027	17	3	17.65	14	82.35	0.009 ± 0.0049
71 +	45	6	13.33	39	86.67	0.010 ± 0.0040	37	5	13.51	32	86.49	0.008 ± 0.0041

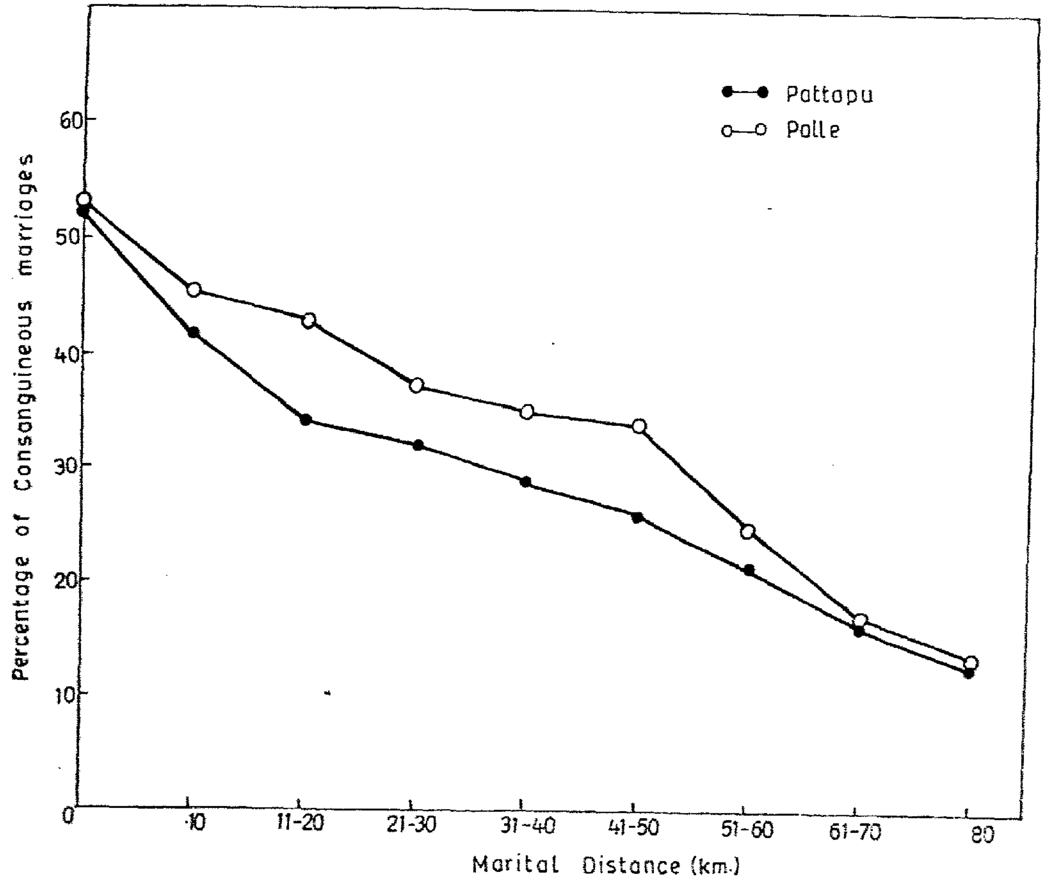


Fig.16 :Consanguinity in relation to Mari Distance

guineous marriages is decreased in 1.72 per cent and 2.37 per cent per every unit (10 km.) increase the marital distance in Pattapu and Palle respectively. However, only Pattapu caste shows significant (t = 1.976) decreasing trend regarding the consanguinity at 5 per cent level of probability.

The highest incidence of consanguinity in the village endogamous unions substantiates the fact that it decreases as the marital distance increases.

CHAPTER - IV

SECTION - B

DIFFERENTIAL HUMAN REPRODUCTION

4B.1. DIFFERENTIAL FERTILITY

4B.1.1. Duration of effective married life

4B.1.2. Income

4B.1.3. Parental consanguinity

4b.1.4. Family planning adoption

4B.1.5. Prediction of fertility parameters with socio-economic, demographical biological variables

4B.2. DIFFERENTIAL MORTALITY

4B.2.1. Biological factors

4B.2.2. Parental consanguinity

4B.2.3. Mortality load disclosed by Inbreeding

4B.2.4. Prediction of mortality parameters with socio-economic, demographic and biological variables

4B.2.5. Selection Intensity

4B.2.6. Breeding size, effective population size

4B.2.7. The opportunity for drift

DIFFERENTIAL HUMAN REPRODUCTION

The effects of Bio-social factors and parental consanguinity on fertility, mortality are understood through empirical comparison among Pattapu and Palle couples. Several available reports on the subject from different parts of the world are not strictly comparable due to the heterogeneity in the methodology and variability in their living conditions and cultures. The present study is mainly devoted to analyse the past reproductive history collected from married women to understand the effects of bio-social factors and parental consanguinity among Pattapu and Palle caste groups.

4B.1 DIFFERENTIAL FERTILITY

Fertility is a complete process responsible for the biological maintenance of the society. In the present study, fertility is measured by average number of pregnancies, live births and surviving offspring in relation to duration of effective married life, income, parental consanguinity and family planning among Pattapu and Palle.

4B.1.1 DURATION OF EFFECTIVE MARRIED LIFE

The relationship between duration of effective married life and fertility measures are studied among Pattapu and Palle and the results are given in Table 22. A pronounced positive association is observed between pregnancies, live births and surviving offspring and duration of effective married life in both caste groups except in 30 years and above group which is due to inadequate sample size. The coefficient of correlation calculated for the number of pregnancies and duration of marriage are 0.719 (Pattapu) and 0.695 (Palle), for the number of live births and duration of marriage are 0.716 (Pattapu) and 0.616 (Palle) and for the number of serviving offspring and duration of marriage are 0.660 (Pattapu) and 0.641 (Palle), indicating significant positive relationship. Finally, more or less these two

TABLE-22

MEAN NUMBER OF PREGNANCIES, LIVE BIRTHS AND SURVIVING OFFSPRING BY DURATION OF EFFECTIVE MARRIED LIFE AMONG PATTAPU AND PALLE

Duration of effective married life	No. of families	Pregnancies Mean ± S.E.	Live Births Mean ± S.E.	Surviving Offspring Mean ± S.E.
Pattapu:				
0 - 5	118	0.932 ± 0.084	0.924 ± 0.084	0.746 ± 0.082
6 - 10	132	2.992 ± 0.094	2.939 ± 0.094	2.409 ± 0.082
11 - 15	112	3.804 ± 0.124	3.759 ± 0.126	3.143 ± 0.102
16 - 20	57	4.579 ± 0.244	4.456 ± 0.251	3.579 ± 0.198
21 - 25	153	6.124 ± 0.211	6.105 ± 0.209	4.556 ± 0.161
26 - 30	65	6.984 ± 0.344	7.000 ± 0.344	4.615 ± 0.245
30 <	1	2.000 ± 0.000	2.000 ± 0.000	2.000 ± 0.000
Correlation values:		0.719	0.716	0.660
Palle:				
0 - 5	106	0.943 ± 0.092	0.906 ± 0.089	0.726 ± 0.077
6 - 10	104	2.615 ± 0.130	2.529 ± 0.126	2.048 ± 0.113
11 - 15	84	3.917 ± 0.157	3.881 ± 0.155	3.071 ± 0.145
16 - 20	62	5.290 ± 0.269	5.242 ± 0.281	3.855 ± 0.213
21 - 25	131	6.099 ± 0.210	6.000 ± 0.210	4.420 ± 0.161
26 - 30	49	6.918 ± 0.311	6.592 ± 0.307	4.347 ± 0.273
30 <	8	6.000 ± 1.090	5.750 ± 1.086	4.750 ± 0.980
Correlation values:		0.695	0.616	0.641

caste groups did not show much difference in each group of duration of effective married life. Same trend is also observed by Gunasundaramma (1980) among Balijas of Andhra Pradesh.

4B.1.2 INCOME

The data (table 23) indicate the more or less confirmed pattern of positive curvilinear relationship between income and different fertility measures. To elaborate further, except in low income group (Rs. 0 - 4800) an increased mean number of pregnancies, live births and surviving offspring in both caste groups is observed by increasing income level, implies that high income group is associated with high level of fertility since the high income group families have capability to fulfil the demands and requirements of having large number of children. The coefficients of correlation calculated for number of pregnancies and income are 0.220 (Pattapu) and 0.263 (Palle) for the number of live births and income are 0.228 (Pattapu) and 0.229 (Palle) and for the number of surviving offspring and income are 0.262 (Pattapu) and 0.292 (Palle), indicating significant positive relationship. Finally, more or less these two caste groups did not show much difference in each income group.

TABLE-23

MEAN NUMBER OF PREGNANCIES, LIVE BIRTHS AND SURVIVING OFFSPRING BY INCOME AMONG PATTAPU AND PALLE

Income	No.of Families	Pregnancies	Live Births	Surviving Offspring
		Mean ± S.E.	Mean ± S.E.	Mean ± S.E.
Pattapu:				
0 - 4800	41	3.9756 ± 0.4969	3.9268 ± 0.4979	2.7073 ± 0.338
4801 - 9600	210	3.4619 ± 0.1737	3.3714 ± 0.1741	2.6143 ± 0.1316
9601 - 14400	272	3.8309 ± 0.1518	3.8272 ± 0.1529	2.9301 ± 0.1055
14401 <	115	5.6783 ± 0.2581	5.6522 ± 0.2562	4.3826 ± 0.1954
Correlation values:		0.220	0.228	0.262
Palle:				
0 - 4800	30	3.600 ± 0.5024	3.6333 ± 0.5044	2.4333 ± 0.3518
4801 - 9600	243	3.5514 ± 0.1697	3.4486 ± 0.1681	2.5720 ± 0.1236
9601 - 14400	163	3.7546 ± 0.2120	3.6564 ± 0.2078	2.7914 ± 0.1526
14401 <	108	5.9444 ± 0.2159	3.7315 ± 0.2182	4.3333 ± 0.1805
Correlation values:		0.263	0.229	0.292

4B.1.3 PARENTAL CONSANGUINITY

The relationship between different types of parental consanguinity and means of different fertility measures among Pattapu and Palle is shown in Tables 24 & 25 respectively.

4B.1.3.1 Pregnancies

The mean number of pregnancies is slightly higher in the non-consanguineous (4.16) than in the consanguineous (3.86) married couples in Pattapu but not significant, while in Palle, equal mean number of pregnancies (4.07) observed in consanguineous marriages the highest mean number of pregnancies observed in uncle-niece marriage (4.45)of Pattapu and first cousin once removed marriage (4.55) of Palle. The analysis by degree of consanguinity reveals decreasing trend in pregnancies from uncle-niece to second cousin in Pattapu but in Palle increasing trend observed with an exception in first cousin once removed in both caste groups.

4B.1.3.2 Live births

The mean number of live births is slightly higher in the non-consanguineous (4.13) than in the consanguineous (3.80)

TABLE-24

MEAN NUMBER OF PREGNANCIES, LIVE BIRTHS, AND SURVIVING OFFSPRING BY TYPE OF CONSANGUINITY IN PATTAPU

Parental Relationship	Women Observed	Pregnancies		Live Births		Surviving Offspring	
		n	Mean ± S.E.	n	Mean ± S.E.	n	Mean ± S.E.
Non-Consanguineous	413	1716	4.16 ± 0.14	1705	4.13 ± 0.14	1314	3.18 ± 0.10
Consanguineous	225	869	3.86 ± 0.17	855	3.80 ± 0.17	648	2.88 ± 0.13
Uncle-niece	31	138	4.45 ± 0.53	138	4.48 ± 0.53	95	3.06 ± 0.44
First Cross Cousin	135	531	3.93 ± 0.22	522	3.87 ± 0.22	399	2.96 ± 0.16
Mother's Brother's daughter	107	423	3.95 ± 0.24	416	3.88 ± 0.24	319	2.98 ± 0.17
Father's Sister's daughter	28	108	3.86 ± 0.54	106	3.79 ± 0.53	80	2.86 ± 0.36
First Cousin once removed	25	100	4.00 ± 0.53	99	3.96 ± 0.53	74	2.96 ± 0.35
Second Cousin	34	100	2.94 ± 0.33	96	2.82 ± 0.34	80	2.35 ± 0.30
Total	638	2585	4.05 ± 0.11	2560	4.01 ± 0.11	1962	3.08 ± 0.08

TABLE-25

MEAN NUMBER OF PREGNANCIES, LIVE BIRTHS AND SURVIVING OFFSPRING BY TYPE OF CONSANGUINITY IN PALLE

Parental Relationship	Women Observed	Pregnancies		Live Births		Surviving Offspring	
		n	Mean $\pm$ S.E.	n	Mean $\pm$ S.E.	n	Mean $\pm$ S.E.
Non-Consanguineous	317	1291	4.07 ± 0.15	1277	4.03 ± 0.15	987	3.11 ± 0.12
Consanguineous	227	924	4.07 ± 0.18	888	3.91 ± 0.18	633	2.79 ± 0.13
Uncle-niece	48	167	3.48 ± 0.33	161	3.35 ± 0.31	114	2.38 ± 0.22
First Cross Cousin	126	519	4.12 ± 0.26	493	3.91 ± 0.25	361	2.87 ± 0.19
Mother's Brother's daughter	77	315	4.09 ± 0.34	297	3.86 ± 0.33	215	2.79 ± 0.23
Father's Sister's daughter	49	204	4.16 ± 0.40	196	4.00 ± 0.38	146	2.98 ± 0.31
First Cousin once removed	29	132	4.55 ± 0.52	131	4.52 ± 0.52	83	2.86 ± 0.41
Second Cousin	24	106	4.42 ± 0.53	103	4.29 ± 0.55	75	3.13 ± 0.38
Total	544	2215	4.07 ± 0.12	2165	3.98 ± 0.12	1620	2.98 ± 0.09

married couples in Pattapu, while similar trend of it has been observed in the Palle (4.03 and 3.91 respectively). However, in consanguineous and non-consanguineous marriages no significant variation is observed in the occurrence of mean number of live births between them both in Pattapu and Palle caste groups. Within consanguineous marriages the highest mean number of live births is observed in uncle-niece marriage (4.48) of Pattapu, and first cousin once removed marriage (4.52) of Palle. The analysis by degree of consanguinity reveals decreasing trend in live births from uncle-niece to second cousin in Pattapu but in Palle increasing trend observed with an exception in first cousin once removed in both caste groups.

4B.1.3.3 Surviving offspring

The mean number of surviving offspring is observed to be higher in the non-consanguineous (3.18) than in the consanguineous (2.88) married couples in Pattapu group as well as in Palle group (3.11 and 2.79 respectively). However, the consanguineous and non-consanguineous marriages fail to reveal any significant difference between their mean number of live births both in Pattapu and Palle groups. Within consanguineous marriages the highest mean number of surviving offspring is observed in uncle-niece marriage of Pattapu

(3.06) and second cousin marriage of Palle (3.13). The analysis by degree of consanguinity reveals decreasing trend in surviving offspring from uncle-niece to second cousin in Pattapu but in Palle increasing trend observed with an exception in first cousin once removed in both caste groups.

The above results regarding fertility reveals that lower fertility among consanguineously married couples than non-consanguineously married couples. Similar trend is observed by some investigations (Bemiss, 1858; Marcallo et al. 1964; Conterio, 1969; Reid, 1976 and Manjuvani, 1987), which supports the idea that inbreeding reduces Darwinian fitness.

4B.1.4 FAMILY PLANNING ADOPTION

A separate analysis is made to understand the fertility differences among the family planning adopters and women of completed reproduction. 134 families of Pattapu and 104 families of Palle adopted the tubectomy/vasectomy family planning methods. The mean number of pregnancies, live births and surviving offspring of the family planning adopters and women who attained menopause are given in Table 26. The mean number of pregnancies in family planning adopters is 4.13 in Pattapu 3.91 in Palle which are lower than those of women

TABLE-26

IEAN NUMBER OF PREGNANCIES, LIVE BIRTHS AND SURVIVING OFFSPRING BY FAMILY PLANNING ADOPTERS AND MENOPAUSE COMPLETED WOMEN

	Women Observed	Pregnancies		Live Births		Surviving Offspring	
		n	Mean ± S.E.	n	Mean ± S.E.	n	Mean ± S.E.
Pattapu:							
Menopause Completed Women (MCW)	203	1283	6.32 ± 0.19	1276	6.29 ± 0.20	914	4.50 ± 0.14
F.P.Adopted (FPA)	134	553	4.13 ± 0.11	549	4.10 ± 0.11	472	3.52 ± 0.09
Total	337	1836	5.45 ± 0.14	1825	5.42 ± 0.14	1386	4.11 ± 0.10
t value between MCW and FPA			9.9751		9.5946		5.8882
Palle:							
Menopause Completed Women (MCW)	188	1186	6.31 ± 0.18	1163	6.19 ± 0.18	822	4.37 ± 0.15
F.A.Adopted (FPA)	104	407	3.91 ± 0.15	398	3.83 ± 0.14	337	3.24 ± 0.13
Total	292	1593	5.46 ± 0.14	1561	5.35 ± 0.14	1159	±3.97 ± 0.11
t value between MCW and FPA			10.243		10.3493		5.6929

who have completed reproduction (6.32 in Pattapu and 6.31 in Palle). The mean number of live births (4.10 in Pattapu and 3.83 in Palle) as well as surviving offspring (3.52 in Pattapu and 3.24 in Palle) of family planning adopters also lower than menopause completed women (live births: 6.29 in Pattapu and 6.19 in Palle; surviving offspring: 4.50 in Pattapu and 4.37 in Palle). t-values show significant difference between menopause completed women and family planning adopters for pregnancies (9.97 and 10.24 in Pattapu and Palle), live births (9.59 and 10.35 in Pattapu and Palle) and surviving offspring (3.89 and 5.69 in Pattapu and Palle) at 1 per cent probability level. The lower mean values for fertility measures are observed in case of family planning adopters due to the fact that they got sterilisation operation after achieving the target of the desired number of offspring. Hence, fertility is not completed in adopters. Another reasons for this might be that by undergoing this sterilisation operation they get monitary benefits or sometimes material benefits also. This can be substantiated from the fact that fifteen cases of families in which both husband and wife underwent vasectomy and tubectomy respectively at different times in both caste groups.

4B.1.5 PREDICTION OF FERTILITY PARAMETERS WITH SOCIO-ECONOMIC, DEMOGRAPHIC AND BIOLOGICAL VARIABLES

4B.1.5.1 Pregnancies

Multiple regression (step-wise) analysis carried out to explain the influence of individual independent variables on the pregnancies, and also assess combined effect of several factors. The summary of each step of the multiple regression analysis (which is the output of computer analysis) is given in Table 27. In this analysis number of pregnancies are taken as dependent variable.

The results indicate that these independent variables had different implications in Pattapu and Palle caste groups. Coefficient of duration of effective married life in Pattapu (1.005) and Palle (1.079) were positive and significant at 1 per cent probability level. These values indicate that pregnancies increases by 1.005 units in Pattapu and 1.079 units in Palle for every unit (5 years) by increase in duration of effective married life. In Palle coefficient of income was positive and significant at 1 per cent probability level, indicate pregnancies increase by 0.104 units for every unit (Rs. 4800) increasing in income.

TABLE-27

STEP WISE REGRESSION OF PREGNANCIES

Independent Variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:						
Duration of effective married life	1.00497	0.1201	8.3678**	0.7190	0.9834	0.9820
Income	-0.01973	0.01732	-1.1391	0.2200		0.0013
Marriage type	-0.00417	0.00545	-0.7643	0.0160		0.0001
Marital distance	-0.00280	0.00585	-0.4780	-0.0110		0.00003
Age at puberty	0.00320	0.01733	0.1847	-0.0120		0.00001
Women age at marriage	0.00146	0.00773	0.1884	0.0120		0.00001
Family Planning	-0.00270	0.02026	-0.1330	0.0100		0.000001
Palle:						
Duration of effective married life	1.07936	0.02246	48.0570**	0.6950	0.9427	0.9328
Income	0.10447	0.0356	2.9341**	0.2630		0.0083
Marital distance	0.01693	0.01207	1.4019	0.0130		0.0002
Age at puberty	0.03189	0.03792	0;8408	-0.0080		0.0001
Women age at marriage	-0.00718	0.01267	-0.5666	0.1830		0.0012
Family planning	0.01012	0.04781	0.2117	-0.0370		0.0001
Marriage type	-0.00206	0.01109	-0.1855	0.0140		0.00003

** Significant at 1 per cent probability level

Remaining all independent variable some variables showed negative coefficient value and some variables showed positive coefficient value but with insignificant in both caste groups. So, these independent variables were not showing any significant effect on pregnancies. However, all independent variables together had explained 98.34 per cent and 94.27 per cent of variation in pregnancies of Pattapu and Palle respectively. Out of these, only duration of effective married life was found to be the most prominent predictor, individually contributing 98.20 per cent in Pattapu and 93.28 per cent in Palle of the total variance. Remaining independent variables showed negligible variation of pregnancies in both caste groups.

4B.1.5.2 Live Births

To examine the independent influence of individual variables on live births, and also to assess the combined effect of other factors, a stepwise multiple regression analysis was done. The results are summarised in Table-28 which showed differential influence of variables in Pattapu and Palle caste groups. Here live births have been taken as dependent variable and the socio-economic, demographic and biological variables have been considered as independent variables.

TABLE-28

STEP WISE REGRESSION OF LIVE BIRTHS

	Independent variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution to variable
Pattapu:							
	Pregnancies	0.98683	0.00759	130.0501**	0.992	0.9834	0.9750
	Income	0.03516	0.01736	2.0248*	0.228		0.0024
	Duration of effective married life	0.01333	0.01211	1.1005	0.716		0.0059
	Marriage type	0.00341	0.00548	0.6218	0.020		0.0001
	Marital distance	0.00305	0.00588	0.5189	-0.007		0.00002
	Family Planning	0.01049	0.02036	0.5154	0.012		0.00003
	Age at puberty	-0.00075	0.01741	0.0436	-0.012		0.00003
	Women age at marriage	0.00064	0.00777	0.0819	0.012		0.00001
Palle:	Pregnancies	1.06458	0.01744	61.0449**	0.962	0.9320	0.8681
	Duration of effective married life	0.14275	0.02774	5.1458**	0.616		0.0516
	Women age at marriage	0.04780	0.01425	3.3537**	0.228		0.0092
	Income	-0.07693	0.04054	1.8974	0.229		0.0027
	Marital distance	-0.02138	0.01372	1.5582	0.002		0.00004
	Age at puberty	-0.05569	0.04309	1.2926	-0.018		0.0003
	Marriage type	0.00503	0.01253	0.4010	0.018		0.0001

* Significant at 5 per cent probability level ** Significant at 1 per cent probability level

Regression coefficient of pregnancies in Pattapu (0.987) and Palle (1.065) were positive and significant at 1 per cent level of probability. These values indicate that live births increase by 0.987 units in Pattapu and 1.065 units in Palle for every unit increase in pregnancies. In Pattapu coefficients for income were positive and significant at 5 per cent probability level, and thus live births increase by 0.035 units for every unit (Rs. 4800) increase in income. For the remaining all independent variables the coefficient were positive and insignificant in Pattapu caste group except the independent variable of age at puberty where coefficient was negative, thus indicating that the variable have no significant effect on live births. Where as in Palle, duration of effective married life and women age at marriage were positive and significant at 1 per cent level of probability explaining that live births increase by 0.14 units and 0.05 units for every unit (5 years) increase in duration of effective married life and women age at marriage respectively. In the remaining all independent variables the coefficient in Palle were negative and insignificant except the variable of Degree of consanguinity where coefficient was positive thus showing no effect on live births. However, all these variable together had explained 98.34 per cent and 93.20 per cent of variation in live births of Pattapu and Palle respectively. Out of these only pregnancies was

found to be the most prominant predictor, individually contributing 97.50 per cent in Pattapu and 86.81 per cent in Palle of the total variance. Remaining all independent variables showed negligible variation of live births in Pattapu and Palle caste groups except independent variable of duration of married life in Palle which showed low contribution (5.16%) to the total variance.

4B.1.5.3 Surviving offspring

Socio-economic, demographic and biological factors were considered as independent variables to explain the variance in surviving offspring and to estimate, what amount of variance could be explained with the help of these several factors. The step-wise regression analysis was carried out and the result of each step and the summary of result at the last step are presented in Table-29.

It could be observed from the table that these independent variables had different implications in Pattapu and Palle caste groups. The regression coefficient 0.641 in Pattapu indicated that surviving offspring increased by 0.641 units for every unit increase in live births and is significant at 1 per cent level of probability. In case of Palle coefficient of pregnancies 0.357 indicated that surviving offspring increased by 0.357 units for every unit increase in pregnancies and is significant at 1 per cent level of probability. In the second step the family

TABLE-29

STEP WISE REGRESSION OF SURVIVING OFFSPRING

	Independent variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:							
	Live births	.64050	.10097	6.3435**	.885	.8003	0.6681
	Family Planning	.30168	.05156	5.8509**	.108		0.0114
	Income	.15721	.04412	3.5634**	.262		0.0171
	Duration of effective married life	.08665	.03069	2.8231**	.660		0.0484
	Age at puberty	.07828	.04410	1.7752	.012		0.0004
	Marriage type	.01928	.01388	1.4282	.042		0.0011
	Pregnancies	-.04506	.10148	0.4441	.876		0.0538
	Marital distance	-.00408	.01489	0.2740	-.000		0.0000
	Women age at marriage	-.00262	.01968	0.1334	.006		0.00001
Palle:	Pregnancies	.35681	.07092	5.0310**	.802	.7024	0.3980
	Women age at marriage	-.13331	.02079	6.4123**	-.017		0.0028
	Marriage type	.06836	.01820	3.7566**	.096		0.0089
	Income	.21044	.05888	3.5743**	.292		0.0259
	Duration of effective married life	.14971	.04114	3.6391**	.641		0.0819
	Family Planning	.20146	.07844	2.5684*	.042		0.0026
	Live births	.16030	.06229	2.5734*	.772		0.1810
	Age at puberty	.10981	.06225	1.7640	.025		0.0011
	Marital distance	-.00244	.01984	0.1229	.005		0.0002

* Significant at 5 per cent probability level ** Significant at 1 per cent probability level

planning (0.302) and women's age at marriage (-0.133) were entered in Pattapu and Palle respectively. The negative coefficient value indicated that surviving offspring decreased for every unit increased in women's age at marriage in Palle but coefficient of family planning indicate that surviving offspring increased by 0.302 units from vasectomy to tubectomy of Pattapu. These were significant at 1 per cent level of probability. In the third step the income (0.157) and marriage type (0.068) were entered in regression equation of Pattapu and Palle respectively. Their coefficient values indicated that surviving offspring increase for every unit (Rs. 4800) increase in income of Pattapu and marriage type of Palle. These were significant at 1 per cent probability level. In the fourth step the duration of effective married life (0.087) and income (0.210) were entered in regression analysis of Pattapu and Palle respectively. These coefficient values indicate that surviving offspring increase for every unit (5 years) increase in duration of effective married life of Pattapu and income (Rs. 4800) of Palle. These were significant at 1 per cent probability level. In Palle the duration of effective married life entered in fifth step and coefficient value (0.150) indicated the surviving offspring increase for every unit (5 years) increase in duration of effective married life and significant at 1 per cent level of probability. In the sixth and seventh steps of

Palle, family planning (0.201) and live births (0.160) entered and their coefficient value indicated that surviving offspring increased for every unit increased in family planning (from vasectomy to tubectomy) and live births. These were significant at 5 per cent probability level. Remaining all independent variables, showed both positive and negative coefficient values and are insignificant in both caste groups. So these independent variables did not show a significant effect on surviving offspring. However, all independent variables together had explained 80.03 per cent and 70.24 per cent of variation in surviving offspring of Pattapu and Palle respectively. Out of these live births of Pattapu and pregnancies of Palle were found to be the most prominent predictors, individually contributing 66.81 per cent (Live births) in Pattapu and 39.80 per cent (pregnancies) in Palle of the total variance. Next important variables pregnancies in Pattapu and live births in Palle were contributing 5.38 and 18.10 per cent to the total variance respectively. And also duration of effective married life is contributing 4.84 per cent in Pattapu and 8.19 per cent in Palle of total variance. Remaining independent variables showed negligible variation of surviving offspring in both caste groups.

4B.2 DIFFERENTIAL MORTALITY

Mortality, an important parameter of population structure, includes both prenatal and post-natal deaths. Mortality patterns influence the genetic composition of populations by differential survival of various genotypes or genes. In the present study, mortality was measured for foetal losses, infant deaths (Neo-natal and Post-neo-natal) and post-natal deaths in relation to biological factors such as mother's age at the time of delivery, birth order and parental consanguinity among Pattapu and Palle.

4B.2.1 BIOLOGICAL FACTORS

4B.2.1.1 Mother's age at the time of delivery

Mother's age at the time of delivery has a significant effect on the probability of mortality. Mortality rates are greater when the mother is either very young (under 20 years) or relatively older (over 35 years). In the present study, the mother's age at the time of delivery in relation to different mortality measures are undertaken as follows:

4B.2.1.1.1 Foetal Loss

Table 30 shows the distribution of foetal loss per 100 pregnancies according to mother's age at the time of delivery.

TABLE-30

FOETAL LOSS RATES (FLR) AND AGE OF MOTHER AT THE TIME OF DELIVERY AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu		Palle	
	Pregnancies	FLR per 100	Pregnancies	FLR per 100
<20	392	2.55	301	3.65
20 - 24	597	2.01	562	3.20
25 - 29	732	1.09	686	2.04
30 - 34	576	1.22	439	2.05
35 - 39	247	1.62	199	3.02
40 >	41	2.44	28	3.57
Total	2585	1.62	2215	2.66

It is observed that the incidence of foetal loss is highest among the mothers aged below 20 years, accounting the foetal loss 2.5 per cent in the Pattapu and 3.65 per cent in Palle. The frequency of foetal loss tends to decrease with an increase in the maternal age upto age group of 25-29 years and then increases after 29 years of age. The difference (F-7.958) is observed to be significant between caste groups at 5 per cent level of probability.

4B.2.1.1.2 Post-natal mortality

The neonatal mortality (0-1 month) rate per 100 live births according to the mother's age at the time of delivery is given in Table 31 which indicates the incidence of neonatal mortality is the highest among the mothers of older age-group (40 years and above) i.e. 10 per cent in Pattapu and 11.11 per cent in Palle. Neonatal mortality tends to decrease from younger age group (below 20 years) to age group of 30-34 in Pattapu, 25-29 years age group in Palle and afterwards neonatal mortality increases with the increase in maternal age in both the caste groups. The analysis by sex also reveals some trend in both caste groups with few exceptions. There is highly significant difference between sexes (F=229.51 in Pattapu and 462.14 in Palle) in both castes and between caste groups (F=13.35) at 1 per cent level of probability.

TABLE-31

NEONATAL (0-1 MONTH) MORTALITY RATES (NMR) AND AGE OF MOTHER AT THE TIME OF DELIVERY BY SEX AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu				Palle			
	Live Births	NMR per 100			Live Births	NMR per 100		
		Male	Female	Total		Male	Female	Total
< 20	384	6.77	3.13	9.90	291	7.90	3.09	10.99
20 - 24	590	6.61	2.71	9.32	547	7.13	2.93	10.06
25 - 29	730	6.15	2.05	8.22	674	6.97	2.81	9.78
30 - 34	572	5.77	2.45	8.22	431	7.19	3.01	10.20
35 - 39	244	6.15	2.46	8.61	195	7.69	3.06	10.75
40 <	40	7.50	2.50	10.00	27	7.41	3.70	11.11
Total	2560	6.29	2.50	8.79	2165	7.25	2.95	10.21

The distribution of post-neonatal (1 m. to 1 yr.) mortality rate per 100 live births by mothers age at the time of delivery is given in table 32 which reveals that the incidence of post-neonatal mortality tends to decrease from maternal younger age group (below 20 years) to maternal age group of 25-29 in both caste groups, after 29 years in both caste post-neonatal mortality increased with the increase in maternal age except in age group of 40 years and above. Similar trend is also observed in both castes by sexwise. There is a significant difference observed between sexes only in Palle (F=5.86), and between castes (F=9.34) at 5 per cent level of probability.

Infant mortality (0-1 yr.) rate per 100 live births according to mother's age at the time of delivery given in Table 33, and it is found that the incidence of infant mortality tends to decrease from younger maternal age group (below 20 years) to maternal age group of 25-29 yrs. in both the caste groups, after 29 years in both castes infant mortality increased with the increase in maternal age except in age group of 40 years and above in Palle caste groups. Similar trend is observed in both castes by sexwise with fewer exceptions. There is significant difference observed between the sexes in both caste groups (F=57.94 in Pattapu and 79.14 in Palle) and between castes (F=19.49 at 1 per cent level of probability.

TABLE-32

POST-NEONATAL (1m.-1 year) MORTALITY RATES (PNMR) AND AGE OF MOTHER AT THE TIME OF DELIVERY BY SEX AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu				Palle			
	Live* Births	PNMR per 100			Live* Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
<20	346	4.34	4.05	8.39	259	7.34	3.86	11.20
20 - 24	535	3.55	3.93	7.48	492	5.49	3.86	9.35
25 - 29	670	3.43	3.88	7.31	608	4.77	3.78	8.55
30 - 34	525	3.81	4.38	8.19	387	5.43	3.88	9.30
35 - 39	223	4.04	4.48	8.52	174	5.75	4.02	9.77
40 <	36	5.56	2.78	8.33	24	8.33	-	8.33
Total	2335	3.77	4.07	7.84	1944	5.56	3.81	9.37

* Live births - Neonatal deaths

TABLE-33

INFANT (0-1 year) MORTALITY RATES (IMR) AND AGE OF MOTHER AT THE TIME OF DELIVERY BY SEX AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu				Palle			
	Live Births	IMR per 100			Live Births	IMR per 100		
		Male	Female	Total		Male	Female	Total
< 20	384	10.68	6.77	17.45	291	14.43	6.53	20.96
21 - 24	590	9.83	6.27	16.10	547	12.07	6.40	19.17
25 - 29	730	9.32	5.62	14.94	674	11.28	6.23	17.51
30 - 34	572	9.27	6.47	15.74	431	12.06	6.50	18.56
35 - 39	244	9.84	6.56	16.40	195	12.82	6.67	19.49
40 <	40	12.50	5.00	17.50	27	14.81	3.70	18.51
Total	2560	9.73	6.21	15.94	2165	12.24	6.37	18.61

Post-natal mortality (1 yr. - 14 yrs. and 0-14 yrs.) rate per 100 live births by mother's age at the time of delivery is shown in table 34 and 35. It is observed that there is no specific trend discerned by mothers age at the time of delivery in both castes. By sex-wise also specific trend is not observed. In post-natal mortality (0-14 years), there is significant difference between sexes (F=29.44 in Pattapu and 32.14 in Palle) at 1 per cent level of probability but not significant between the castes.

Table 36 shows the distribution of total mortality (prenatal and post-natal) rate per 100 pregnancies according to mothers age at the time of delivery. The incidence of total mortality is highest among the mothers aged below 20 years (26.53% in the Pattapu and 29.90% in Palle). The total mortality tends to decrease with an increase in the maternal age upto age group of 25-29 years and then increases after 29 years of age. The difference (F=5.51) is observed to be significant between caste groups at 5 per cent level of probability.

Thus, above results indicated that the mother's of extreme ages i.e. younger and older age groups, experienced greater mortality rates thus confirming the findings of earlier studies (Srivastava and Saksena, 1981; Islam et al.,

TABLE-34

POST-NATAL (1-14 years) MORTALITY RATES (PNMR) AND AGE OF MOTHER AT THE TIME OF DELIVERY BY SEX AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu				Palle			
	Live* Births	PNMR per 100			Live* Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
< 20	317	3.79	4.73	8.52	230	4.78	3.04	7.82
21 - 24	495	3.43	4.44	7.88	446	4.48	2.47	6.95
25 - 29	621	3.38	4.51	7.89	556	2.88	3.24	6.12
30 - 34	482	3.32	3.73	7.05	351	3.70	4.27	7.98
35 - 39	204	3.92	4.41	8.33	157	2.55	3.18	5.73
40 <	33	3.03	3.03	6.06	22	4.55	-	4.55
Total	2152	3.49	4.32	7.81	1762	3.69	3.18	6.87

* Live births - Infant deaths

TABLE-35

POST-NATAL (0-14 years) MORTALITY RATES (PNMR) AND AGE OF MOTHER AT THE TIME OF DELIVERY BY SEX AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu				Palle			
	Live Births	PNMR per 100			Live Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
< 20	384	13.80	10.68	24.48	291	18.21	8.93	27.14
21 - 24	590	12.71	10.00	22.71	547	15.72	8.41	24.13
25 - 29	730	12.19	9.45	21.64	674	13.65	8.90	22.55
30 - 34	572	12.06	9.62	21.68	431	15.08	9.88	25.06
35 - 39	244	13.11	10.25	23.36	195	14.87	9.23	24.10
40 <	40	15.00	7.50	22.50	27	18.52	3.70	22.22
Total	2560	12.66	9.84	22.50	2165	15.24	8.96	24.20

TABLE-36

TOTAL MORTALITY (PRENATAL AND POSTNATAL UPTO 14 YEARS) RATES(TMR) AND MOTHER'S AGE AT THE TIME OF DELIVERY AMONG PATTAPU AND PALLE

Age of mother at the time of delivery (yrs.)	Pattapu		Palle	
	Pregnancies	TMR per 100	Pregnancies	TMR per 100
< 20	392	26.53	301	29.90
20 - 24	597	24.46	562	26.69
25 - 29	732	22.68	686	24.20
30 - 34	576	22.74	439	26.65
35 - 39	247	24.70	199	26.63
40 <	41	24.39	28	25.00
Total	2585	23.91	2215	26.32

1982; Edmonston, 1983, Adlakha, 1984; Buzarbaruah and Phookan, 1984 and Vimala Kumary, 1988).

4B.2.1.2 Birth order

Birth order has a significant effect on the probability of mortality. Studies confirmed higher risk of death to first born children mainly due to the higher proportion of younger women having first births rather than first order births and the higher order births takes place when the mother is at the end of her reproductive period.

4B.2.1.2.1 Foetal loss

Foetal loss rate per 100 pregnancies according to birth order among Pattapu and Palle is presented in table 37 which reveals the foetal loss rate among the first borns is 2.39% and 3.02% for the Pattapu and Palle, respectively. The risk of foetal loss fell down to 0.59% for the Pattapu and 2.43% for the Palle when the birth order increased from first to fourth. Again the risk of foetal loss increased slowly with higher birth order i.e. 2.63% for seventh birth order of Pattapu and 4.76% for 10th birth order in Palle with exception in sixth birth order of Palle. There is significant (8.736) difference observed between the caste groups at 5 per cent level of probability.

TABLE-37

FOETAL LOSS RATES (FLR) BY BIRTH ORDER AMONG PATTAPU AND PALLE

Birth order	Pattapu		Palle	
	Pregnancies	FLR per 100	Pregnancies	FLR per 100
1	587	2.39	497	3.02
2	507	1.78	440	2.95
3	446	1.57	358	2.79
4	340	0.59	288	2.43
5	243	1.65	226	2.65
6	181	1.66	167	1.80
7	114	2.63	103	2.91
8	77	-	61	-
9	46	-	39	-
10	28	-	21	4.76
11	11	-	11	-
12	4	-	4	-
13	1	-	-	-
Total	2585	1.62	2215	2.66

4B.2.1.2.2 Post-natal mortality

The neonatal mortality (0-1 m) rate per 100 live births by birth order is given in table 38, which explains that the neonatal mortality rate occurred among the first birth orders with 11.28 and 12.14% for the Pattapu and Palle groups respectively. Neonatal mortality decreased to 5.8% in fifth birth order of Pattapu and to 9.20% in third birth order of Palle. After these respective birth orders in both castes, neonatal mortality increased with higher birth order i.e., 25% for 12th birth order of Pattapu and Palle with few-exceptions. But similar trend is not observed when sexes are considered separately. However, there is significant difference observed between the sexes (F=18.197 in Pattapu and 25.277 in Palle) in both castes at 1 per cent level of probability but not significant between castes.

The Post-neonatal (1m - 1 yr.) mortality rate per 100 live births according to birth order is given in table 39 which indicates the incidence of post-neonatal mortality rate among first birth orders as 9.78% and 11.01% for the Pattapu and Palle respectively. The risk of post-neonatal mortality fell down upto fourth birth order (6.54%) of Pattapu and third birth order (8.54%) of Palle. After these respective birth orders, Post-neonatal mortality increases with higher birth

TABLE-38

NEONATAL (0-1m.) MORTALITY RATES (NMR) AND BIRTH ORDER BY SEX AMONG PATTAPU AND PALLE

Birth order	Pattapu				Palle			
	Live Births	NMR per 100			Live Births	NMR per 100		
		Male	Female	Total		Male	Female	Total
1	576	8.51	2.78	11.28	486	8.23	3.91	12.14
2	500	5.20	3.60	8.80	429	6.29	3.26	9.56
3	439	6.15	1.59	7.74	348	6.03	3.16	9.20
4	344	4.36	2.33	6.69	281	7.12	2.14	9.25
5	241	4.15	1.66	5.81	220	7.27	2.27	9.55
6	181	5.52	2.21	7.73	164	7.93	1.83	9.76
7	111	4.50	1.80	6.31	101	7.92	2.97	10.89
8	78	10.26	2.56	12.82	61	8.20	3.28	11.48
9	46	8.70	6.52	15.22	40	7.50	2.50	10.00
10	28	14.29	-	14.29	20	15.00	-	15.00
11	11	18.18	-	18.18	11	-	-	-
12	4	25.00	-	25.00	4	25.00	-	25.00
13	1	-	-	-	-	-	-	-
Total	2560	6.29	2.50	8.79	2165	7.25	2.96	10.21

order in Palle (11.76% in 10th birth order) but in Pattapu no specific trend is observed. By sexwise specific trend was not observed. There is no significant difference between sexes in each caste group as well as between caste groups.

Infant mortality (0-1 yr.) rate per 100 live births according to birth order is given in table 40. It is found to be 19.47% and 21.81% in the first birth order for the Pattapu and Palle respectively. Infant mortality decreases upto fourth birth order (12.79%) of Pattapu and third birth order (16.95%) of Palle. After these respective birth orders thereafter increases with higher birth order in Palle (25% in 10th and 12th birth orders) but in Pattapu no specific trend is observed. By sex-wise, specific trend was not observed. However, there is significant difference observed between sexes only in Pattapu (F=5.172) at 5 per cent level of probability, but not significant between castes.

Post-natal mortality (1 to 14 years) rate per 100 live births by birth order is given in table 41. It is observed in the table that the incidence of post-natal mortality among first birth orders is 7.59% and 8.68% for the Pattapu and Palle respectively. Post-natal mortality decreases upto sixth birth order (6.37%) of Pattapu and third birth order (6.57%) of Palle. After these respective birth orders, except in 11th

TABLE-40

INFANT (0-1 year) MORTALITY RATES (IMR) AND BIRTH ORDER BY SEX AMONG PATTAPU AND PALLE

Birth order	Pattapu				Palle			
	Live Births	IMR per 100			Live Births	IMR per 100		
		Male	Female	Total		Male	Female	Total
1	576	13.72	6.25	19.97	486	14.40	7.41	21.81
2	500	8.80	7.40	16.20	429	11.66	6.29	17.95
3	439	9.11	5.92	15.03	348	10.63	6.32	16.95
4	344	6.98	5.81	12.79	281	12.46	4.98	17.44
5	241	6.64	6.22	12.86	220	12.27	6.82	19.09
6	181	7.73	5.52	13.26	164	11.59	7.93	19.51
7	111	8.11	4.50	12.61	101	7.92	2.97	10.89
8	78	11.54	6.41	17.95	61	13.11	8.20	21.31
9	46	10.87	10.87	21.74	40	12.50	7.50	20.00
10	28	17.86	-	17.86	20	25.00	-	25.00
11	11	18.18	-	18.18	11	-	-	-
12	4	50.00	-	50.00	4	25.00	-	25.00
13	1	-	-	-	-	-	-	-
Total	2560	9.73	6.21	15.94	2165	12.24	6.37	18.61

TABLE-41

POST-NATAL (1-14 years) MORTALITY RATES (PNMR) AND BIRTH ORDER BY SEX AMONG PATTAPU AND PALLE

Birth order	Pattapu				Palle			
	Live* Births	PNMR per 100			Live* Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
1	461	4.56	3.04	7.59	380	5.53	3.16	8.68
2	419	4.30	4.06	8.35	352	5.40	2.27	7.67
3	373	3.49	4.83	8.31	289	2.77	3.81	6.57
4	300	2.00	4.67	6.67	232	3.02	3.88	6.90
5	210	2.86	3.81	6.67	178	2.25	2.81	5.06
6	157	3.18	3.18	6.37	132	2.27	3.79	6.06
7	97	2.06	7.22	9.28	90	1.11	4.44	5.56
8	64	1.56	7.81	9.38	48	2.08	-	2.08
9	36	2.78	8.33	11.11	32	3.13	3.13	6.26
10	23	4.35	8.70	13.04	15	-	-	-
11	9	11.11	-	11.11	11	-	9.09	9.09
12	2	-	-	-	3	-	-	-
13	1	-	-	-	-	-	-	-
Total	2152	3.49	4.32	7.81	1762	3.69	3.18	6.87

* Live births - Infant deaths

birth order post-natal mortality increases with higher birth order in Pattapu (13.04 in 10th birth order) but in Palle no specific trend observed. There is no significant difference observed between sexes in both castes, but significant difference observed between castes (F=7.213) at 5 per cent probability level.

Post-natal mortality (0-14 years) rate per 100 live births according to birth order, given in table 42, is found to be 26.04% and 28.60% in the first birth order for the Pattapu and Palle respectively. Post-natal mortality decreases upto fourth birth order (18.60%) of Pattapu and third birth order (22.41%) of Palle. After these respective birth orders, Post-natal mortality increases upto 9th birth order (30.43%) after that it decreases in Pattapu, but in Palle no specific trend is observed. By sex-wise, specific trend was not observed. However, there is significant difference observed between sexes only in Palle (F=24.434) at 1 per cent level of probability but not significant between castes.

As seen in table 43, the **total mortality (prenatal and post-natal) rates** by birth order are found to be high in extreme parities comparable to other birth orders. The incidence of total mortality rate among the first birth order

TABLE-42

POST NATAL (0-14 years) MORTALITY RATES (PNMR) AND BIRTH ORDER BY SEX AMONG PATTAPU AND PALLE

Birth order	Pattapu				Palle			
	Live Births	PNMR per 100 Male	PNMR per 100 Female	PNMR per 100 Total	Live Births	PNMR per 100 Male	PNMR per 100 Female	PNMR per 100 Total
1	576	17.36	8.68	26.04	486	18.72	9.88	28.60
2	500	12.40	10.80	23.20	429	16.08	8.16	24.24
3	439	12.07	10.02	22.10	348	12.93	9.48	22.41
4	344	8.72	9.88	18.60	281	14.95	8.19	23.13
5	241	9.13	9.54	18.67	220	14.09	9.09	23.18
6	181	10.50	8.29	18.78	164	13.41	10.98	24.39
7	111	9.91	10.81	20.72	101	8.91	6.93	15.84
8	78	12.82	12.82	25.64	61	14.75	8.20	22.95
9	46	13.04	17.39	30.43	40	15.00	10.00	25.00
10	28	21.43	7.14	28.57	20	25.00	-	25.00
11	11	27.27	-	27.27	11	-	9.09	9.09
12	4	50.00	-	50.00	4	25.00	-	25.00
13	1	-	-	-	-	-	-	-
Total	2560	12.66	9.84	22.50	2165	15.24	8.96	24.20

TABLE-43

TOTAL MORTALITY (PRENATAL AND POST NATAL UPTO 14 YEARS) RATE (TMR) AND BIRTH ORDER AMONG PATTAPU AND PALLE

Birth order	Pattapu		Palle	
	Pregnancies	TMR per 100	Pregnancies	TMR per 100
1	587	27.94	497	30.99
2	507	24.65	440	26.59
3	446	23.32	358	24.58
4	340	19.41	288	25.00
5	243	20.16	226	25.22
6	181	20.44	167	25.75
7	114	22.81	103	18.45
8	77	25.97	61	22.95
9	46	30.43	39	25.64
10	28	28.57	21	28.57
11	11	27.27	11	9.09
12	4	50.00	4	25.00
13	1	-	-	-
Total	2585	23.91	2215	26.32

is 27.94% and 30.99% for the Pattapu and Palle respectively. Then it has decreased to fourth birth order (19.41%) of Pattapu and third birth order (24.58) of Palle. After these respective birth orders, total mortality increased with increasing the birth order with few exceptions. However, there is no significant difference observed between castes.

Thus, the above results for different mortality measures in relation to birth order reveals that the risk for mortality in extreme parities is high comparable to middle birth orders. Similar results were observed in earlier studies (Taussing, 1931 and 1936; Pearl, 1939; Wyon and Gordon, 1962; Stockel and Chowdhury, 1972; Poddar, 1975; WHO, 1976; Meegama, 1980; Palloni 1981 and Mahadevan et al., 1985).

There is a high correlation between the mothers age at the time of delivery and birth order which are taken as a biological parameters and their influence on different mortality measures are studied (Pathak, 1979).

A very young mother is biologically not fully mature, so that the probability of pregnancy related complications are high. Also, younger mother being inexperienced, may not be able to take proper care of the children. Beyond the age of

30 years., the risk of pregnancy complications apparently increases because of the increasing, flexibility of the female reproductive organs.

4B.2.2 PARENTAL CONSANGUINITY

The relationship between different degrees of parental consanguinity and percentage of mortality measures among Pattapu and Palle is given in tables 44 to 50.

4B.2.2.1 Foetal Losses

The percentage rates of foetal loss among the different degrees of consanguinity in the Pattapu and Palle are presented in table 44. The results reveal higher rates in consanguineous (2.30% in Pattapu and 4.11% in Palle) than in non-consanguineous (1.28% in Pattapu and 1.63% in Palle) marriages, the difference between them is significant only in the Palle ($t=3.57$). No specific trend could be discerned by degree of consanguinity in both Pattapu and Palle caste groups. Similar results were observed by some workers (Sutter and Tabah, 1952; Kumar <u>et</u> <u>al</u>., 1967; Basu, 1978; Rao and Inbaraj, 1979; Chandrasekhar, 1989 and Papa Rao, 1989). This indirectly suggests the contribution of much smaller recessive lethal and

TABLE-44

FOETAL LOSS RATES (FLR) AND CONSANGUINITY AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu		Palle	
	Pregnancies	FLR per 100	Pregnancies	FLR per 100
Non-Consanguineous (NC)	1716	1.28	1291	1.63
Consanguineous (C)	869	2.30	924	4.11
Uncle-niece	138	0.72	167	4.19
First Cross Cousin	531	2.45	519	5.01
Mother's Brother's daughter	423	2.60	315	5.71
Father's Sister's daughter	108	1.85	204	3.92
First Cousin once removed	100	1.00	132	0.76
Second Cousin	100	5.00	106	3.77
Total	2585	1.62	2215	2.66

semilethal genes before birth as was held by Schull (1958), Bonne (1963), Reid (1976) in their investigations.

4B.2.2.2 Post-natal mortality

The **neonatal mortality (0-1 m) rate** per 100 live births by **consanguinity** as shown in table 45, is higher in consanguineous (9.94% in Pattapu and 11.59% in Palle) than in non-consanguineous (8.21% in Pattapu and 9.24% in Palle) marriages in both caste groups. The difference is statistically insignificant in both castes. No specific trend could be observed by degree of consanguinity in both castes. Neonatal mortality between the males and females is significant at 1 per cent probability level (F values: 29.013 in Pattapu and 15.286 in Palle), but not significant between castes.

The **post-neonatal** (1m-1 yr.) **mortality rate** per 100 live births according to type of consanguinity in Pattapu and Palle castes as shown in table 46, is found to be higher in consanguineous marriages (8.57% in Pattapu and 11.21% in Palle) than in non-consanguineous marriages (7.48% in Pattapu and 8.11% in Palle) in both caste groups. The differences however are not statistically significant in both castes. The analysis by degree of consanguinity reveals lowest neonatal mortality in uncle-niece marriages followed by first cousin and first cousin

TABLE-45

NEONATAL (0-1m.) MORTALITY RATES (NMR) AND CONSANGUNITY BY SEX AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu				Palle			
		NMR per 100				NMR per 100		
	Live Births	Male	Female	Total	Live Births	Male	Female	Total
Non-Consanguineous (NC)	1705	5.69	2.52	8.21	1277	5.95	3.29	9.24
Consanguineous (C)	855	7.49	2.46	9.94	888	9.12	2.48	11.59
Uncle-niece	138	10.14	3.62	13.77	161	9.94	4.97	14.91
First Cross Cousin	522	8.05	2.11	10.15	493	8.52	0.81	9.33
Mother's Brother's daughter	416	6.97	2.16	9.13	297	8.75	0.34	9.09
Father's Sister's daughter	106	12.26	1.89	14.15	196	8.16	1.53	9.69
First Cousin once removed	99	5.05	3.03	8.08	131	2.21	3.82	16.03
Second Cousin	96	3.13	2.08	5.21	103	6.80	4.85	11.65
Total	2560	6.29	2.50	8.79	2165	7.25	2.96	10.21

TABLE-46

POST NEONATAL (1m-1 year) MORTALITY RATES (PNMR) AND CONSANGUINITY BY SEX AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu				Palle			
	Live* Births	PNMR per 100			Live* Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
Non-Consanguineous (NC)	1565	3.77	3.71	7.48	1159	4.31	3.80	8.11
Consanguineous (C)	770	3.77	4.81	8.57	785	7.39	3.82	11.21
Uncle-niece	119	1.68	6.72	8.40	137	6.57	2.19	8.76
First Cross Cousin	469	4.69	3.84	8.53	447	7.83	4.25	12.08
Mother's Brother's daughter	378	4.76	4.50	9.26	270	8.15	3.33	11.48
Father's Sister's daughter	91	4.40	1.10	5.49	177	7.34	5.65	12.99
First Cousin once removed	91	4.40	5.50	9.90	110	12.73	5.45	18.18
Second Cousin	91	1.10	6.60	7.70	91		2.20	2.20
Total	2335	3.77	4.07	7.84	1944	5.56	3.81	9.37

* Live Births - Neo-natal deaths

once removed with an exception in second cousins in both castes. There is no significant difference between sexes and between castes.

The infant (0-1 yr.) mortality rate per 100 live births according to type of consanguinity in Pattapu and Palle castes as given in table 47, is found to be higher in consanguineous (17.66% in Pattapu and 21.51% in Palle) than in non-consanguineous (15.07% in Pattapu and 16.60% in Palle) marriages in both castes, and the difference being not significant between them. The analysis by degree of consanguinity reveals highest infant mortality in uncle-niece marriages followed by first cousin to second cousin marriages in both castes with an exception in first cousin once removed in Palles. Infant mortality between the males and females is significant at 1 per cent probability level (F-value: 7.135 in Pattapu and 24.808 in Palle), but not significant between Pattapu and Palle.

The Post-natal (1 year-14 years) mortality rate per 100 live births according to the type of consanguinity among Pattapu and Palle as shown in table 48, is found to be higher in consanguineous marriages (7.60%) than in non-consanguineous marriages (6.38%) in Palle, while a reverse trend has been observed in Pattapu. The differences however are not stati-

TABLE-47

INFANT MORTALITY (0-1 year) RATES (IMR) AND CONSANGUINITY BY SEX AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu				Palle			
	Live Births	IMR per 100			Live Births	IMR per 100		
		Male	Female	Total		Male	Female	Total
Non-Consanguineous (NC)	1705	9.15	5.92	15.07	1277	9.87	6.73	16.60
Consanguineous (C)	855	10.88	6.78	17.66	888	15.65	5.86	21.51
Uncle-niece	138	11.59	9.42	21.01	161	15.53	6.84	22.36
First Cross Cousin	522	12.26	5.56	17.82	493	15.62	4.67	20.28
Mother's Brother's daughter	416	11.30	6.25	15.14	297	16.16	3.37	19.53
Father's Sister's daughter	106	16.04	2.83	18.87	196	14.80	6.63	21.43
First Cousin once removed	99	9.09	8.08	17.17	131	22.90	8.40	31.30
Second Cousin	96	4.17	8.33	12.50	103	6.80	6.80	13.60
Total	2560	9.73	6.21	15.94	2165	12.24	6.37	18.61

TABLE-48

POST-NATAL MORTALITY (1 year to 14 years) RATES (PNMR) AND CONSANGUINITY BY SEX AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu				Palle			
	Live Births	PNMR per 100			Live Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
Non-Consanguineous (NC)	1448	3.38	4.56	7.94	1065	3.38	3.00	6.38
Consanguineous (C)	704	3.69	3.84	7.53	697	4.16	3.44	7.60
Uncle-niece	109	4.59	7.34	11.93	125	4.80	3.20	8.00
First Cross Cousin	429	3.96	3.26	7.23	393	3.82	2.80	6.62
Mother's Brother's daughter	343	4.37	3.21	7.58	239	4.60	4.60	9.20
Father's Sister's daughter	86	2.33	3.49	5.81	154	2.60	-	2.60
First Cousin once removed	82	3.66	3.66	7.32	90	3.33	2.22	5.55
Second Cousin	84	1.19	2.38	3.57	89	5.62	7.87	13.48
Total	2152	3.49	4.32	7.81	1762	3.69	3.18	6.87

stically significant in both castes. The analysis by degree of consanguinity reveals highest post-natal mortality in uncle-niece marriages followed by first cousin to second cousin in both castes with an exception in first cousin once removed in Pattapu and second cousin in Palle. Post-natal mortality between sexes and between castes are not significant.

The **post-natal (0 to 14 years) mortality rate** per 100 live births by parental consanguinity among Pattapu and Palle given in Table 49, are found to be higher in consanguineous marriages than in non-consanguineous marriages in either castes, but significant for the Palle only. The analysis by degree of consanguinity reveals, post-natal mortality decreases with the decrease in degree of consanguinity from uncle-niece to second cousin with few exception in Palle. Post-natal mortality between sexes is significant in Palle (F=29.721) only. But not significant between castes.

The **total mortality (prenatal and post natal) rate** by parental consanguinity given in table 50 is found to be significantly higher in consanguineous than non-consanguineous marriages in both Pattapu (25.78 vs 22.96) and Palle (30.52 vs 23.92). The uncle-niece group (31.16%) of the Pattapu shows the highest value where as in the Palle, first cousin once removed (35.61%) shows the highest. The analysis of degree

TABLE-49

POST NATAL MORTALITY (0 to 14 years) RATES (PNMR) AND CONSANGUINITY BY SEX AMONG PATTAPU AND PALLE

Parental Relationship	Pattapu				Palle			
	Live Births	PNMR per 100			Live Births	PNMR per 100		
		Male	Female	Total		Male	Female	Total
Non-Consanguineous (NC)	1705	12.02	9.79	21.82	1277	12.69	9.24	21.93
Consanguineous (C)	855	13.92	9.94	23.86	888	18.92	8.56	27.48
Uncle-niece	138	15.22	15.22	30.43	161	19.25	9.32	28.57
First Cross Cousin	522	15.52	8.24	23.75	493	18.66	6.90	25.56
Mother's Brother's daughter	416	14.90	8.89	23.80	297	19.86	7.07	26.94
Father's Sister's daughter	106	17.92	5.66	23.58	196	16.84	6.63	23.47
First Cousin once removed	99	12.12	11.11	23.23	131	25.19	9.92	35.11
Second Cousin	96	5.21	10.42	15.63	103	11.65	13.59	25.24
Total	2560	12.66	9.84	22.50	2165	15.24	8.96	24.20

TABLE-50

TOTAL MORTALITY (PRENATAL AND POST NATAL UPTO 14 YEARS) RATES (TMR) AND CONSANGUINITY AMONG PATTAPU AND PALLE

Parental relationship	Pattapu		Palle	
	Pregnancies	TMR per 100	Pregnancies	TMR per 100
Non-Consanguineous	1716	22.96	1291	23.32
Consanguineous	869	25.78	924	30.52
Uncle-niece	138	31.16	167	31.74
First Cross Cousin	531	25.80	519	29.29
Mother's Brother's daughter	423	26.00	315	31.11
Father's Sister's daughter	108	25.00	204	26.47
First Cousin once removed	100	24.00	132	35.61
Second Cousin	100	20.00	106	28.30
Total	2585	23.91	2215	26.32

of consanguinity reveals the Pattapu showed increasing mortality rate with decreasing consanguinity where as in Palle inconsistent trend is observed.

The above results generally reveal that inbreeding enhances mortality during infancy. Similar results were also observed in some studies, although its validity appears to be still disputed (Sabzano, 1961; Kriger, 1966; Freira-Maia, 1968; Reid, 1971; Murthy and Jamil, 1972; Mukherjee et al., 1974; Basu, 1975; Rao and Inbaraj, 1977; Ramesh, 1979 and Papa Rao, 1989). These results indirectly indicate that the deleterious genes are effective in infant stage of life.

4B.2.3 MORTALITY LOAD DISCLOSED BY INBREEDING

Mortan, Crow and Muller (1956) proposed a method (MCM) of measuring genetic load based on the relationship of inbreeding coefficient with mortality or morbidity due to deleterious genes. The load, a measure of reduction in fitness due to mortality and morbidity, can be estimated from the effect of consanguinity by expressing the load L as a function of inbreeding F. Thus $1-L=\exp[-(A+BF)]$, where the statistic 'A' indicates the amount of mortality load

expected under random mating and due to non-genetic causes of mortality, while 'B' indicates inbreeding load due to homozygosity of deleterious recessive genes which is purely genetic A+B therefore represents the total load. The values 'A' and 'B' were obtained through weighted least squares technique of Smith (1967) and the goodness of the fit is tested using appropriate Chi-square (χ^2) distribution. These estimates are made for the following classes of pre-reproductive mortality (upto 14 years).

1. Foetal losses: Abortions are foetal deaths upto and including 6th month of gestation, where as still births are foetal deaths from the start of 7th month of gestation to before birth.
2. Infant mortality: Death within one year of birth.
3. Child mortality: Deaths between one year to 14 years of birth.
4. Post-natal Mortality: Infant mortality+Child mortality.
5. Total mortality: Total of all types of mortalities.

The ratio B/A gives an estimate of the number of Loci with heterotic alleles, a low value of which indicates that the load is segregational, i.e., due to the segregation of superior heterozygotes. A high value represents a mutational load which is due to deleterious mutations balancing selection.

Estimates of mortality load disclosed by inbreeding for prenatal mortality, infant mortality, child mortality, post-natal mortality and total mortality are presented in table-51. Goodness of fit by χ^2 analysis showed that the fitted model deviated significantly for all types of mortality in both caste groups except in infant mortality of Pattapu caste group.

It is observed that random loads (A), except post-natal mortality in Palle are lower than the inbreeding loads (B) among positive values, indicating the less effect of environment on mortality, but post-natal mortality in Palle explaining the less inbreeding effect on mortality. They are in accordance with studies of Schull and Neel (1965), Krieger (1972), Cavallisforza and Bodmer (1976), Chengal Reddy (1983), Vogel and Motulsky (1982), Freire-Maia and Elisbar (1984) and Papa Rao (1989) who have also observed high 'B' values in their studies. The consequent high intercept value 'A' in post-natal mortality of Palle would indicate that the observed mortality is correlated more with their living conditions rather than with inbreeding (Ramesh, 1979).

All the B regression coefficients except foetal losses in Pattapu and child mortality in Palle were positive, implying

TABLE-51

ESTIMATES OF GENETIC LOAD FOR DIFFERENT MORTALITY PARAMETERS

Caste	Variables	Estimated Values		B/A	χ^2	d.f
		A $\pm$ S.E.	B $\pm$ S.E.			
Pattapu:						
	Foetal loss	0.0280 $\pm$ 0.0038	-0.1443 $\pm$ 0.0694	-5.1536	18.0904	3
	Infant mortality	0.1477 $\pm$ 0.0093	0.7093 $\pm$ 0.2631	4.8019	2.9780	3
	Child mortality	0.0474 $\pm$ 0.0051	0.3583 $\pm$ 0.1538	7.5657	18.8249	3
	Post natal mortality	0.2023 $\pm$ 0.0110	1.2177 $\pm$ 0.3249	6.0179	15.3423	3
	Total mortality	0.2364 $\pm$ 0.0120	1.0592 $\pm$ 0.3401	4.4808	4.1986	3
Palle:						
	Foetal loss	0.0215 $\pm$ 0.0039	0.2108 $\pm$ 0.1064	9.8256	8.4798	3
	Infant mortality	0.2124 $\pm$ 0.0127	0.3754 $\pm$ 0.2905	1.7677	21.0516	3
	Child mortality	0.0713 $\pm$ 0.0070	-0.1298 $\pm$ 0.1399	-1.8203	11.7719	3
	Post natal mortality	0.2986 $\pm$ 0.0154	0.2630 $\pm$ 0.3414	0.8809	18.3914	3
	Total mortality	0.3268 $\pm$ 0.0162	0.5657 $\pm$ 0.3724	1.7309	15.8841	3

to reflect the real effect of inbreeding in the expression of mortality. In other words, the expression of the rare recessive lethals is not confounded in these groups by the mortality due to environmental factors. This observation needs some reflection in the light of contention of Sanghvi (1960, 1974 and 1978), who suggested that the expressed load in any population is not only a function of mutation and selection, but also the level of inbreeding and the extent of time of operation of that level of inbreeding. The negative regressions of foetal loss in Pattapu and child mortality in Palle might have resulted due to low-genetic mortality, where the deleterious genes are very few or absent and due to presence of homozygotes of genes which are able to survive better because of their adaptive nature (Rao and Murthy, 1986). This can also be explained as a consequence effect of inbreeding on incompatability (Crow and Kimura, 1970 and Renuka Nair and Murthy, 1985).

The B/A ratio in all mortality parameters is greater in Pattapu than in Palle except foetal loss, where the ratio for Palle is greater than Pattapu. The prediction of a difference in ratios of the inbreed load to the random load for segregational or mutational forms the basis for Morton <u>et al's</u>. approach. In the present study, the values of B/A

ratio are found to be below ten in all mortality measures in both caste groups implying the genetic load is segregational. Supporting this some studies revealed that the genetic load is predominantly of segregational nature (Sundara Rao, 1976; Ramesh, 1979; Ghosh and Majumdar, 1979; Sirajuddin and Basu, 1984; Mythili, 1986: Chengal Reddy, 1987 and Papa Rao, 1989). In case of foetal loss in Palle, B/A ratio more or less equal to ten, so the genetic load is nearly mutational than segregational.

Estimates of mortality load disclosed by inbreeding by sex-wise for different mortality measures are given in tables 52 and 53 for Pattapu and Palle respectively. It is observed in both Caste groups B/A ratio of male infant mortality is greater than male child mortality, indicate that male mortality decreased with increasing the age due to better treatment of males than females and expression of lethals in males in infant stage. This trend is reverse in Pattapu females. No consistent trend is observed in Palle females. Apart from inbreeding effect, other factors like socio-economic and biological factors may also be responsible, for such trends of results, and it would seem necessary that studies be planned to take these factors also into consideration. For that only regression analysis was undertaken in different mortality measures.

TABLE-52

SEXWISE GENETIC LOAD ESTIMATES FOR DIFFERENT MORTALITY PARAMETERS IN PATTAPU

Variable		Estimated Values				B/A	χ^2	d.f
		A	± S.E.	B	± S.E.			
Infant mortality	Male	0.07522	± 0.00651	0.4523	± 0.1883	6.0136	13.9995	3
	Female	0.0676	± 0.00612	0.1899	± 0.1635	2.8103	5.1047	3
Child mortality	Male	0.02182	± 0.00345	0.1273	± 0.09929	5.8374	4.9885	3
	Female	0.02501	± 0.00371	0.21886	± 0.1136	8.753	16.0023	3
Post-Natal mortality	Male	0.09898	± 0.00751	0.6061	± 0.2191	6.1237	19.1304	3
	Female	0.0941	± 0.007298	0.4407	± 0.2054	4.6829	7.1741	3

TABLE-53

SEXWISE GENETIC LOAD ESTIMATES FOR DIFFERENT MORTALITY PARAMETERS IN PALLE

Variable		Estimated Values						B/A	χ^2	d.f
		A	±	S.E.	B	±	S.E.			
Infant mortality	Male	0.1302	±	0.009770	0.4302	±	0.2333	3.3052	21.9835	3
	Female	0.07088	±	0.00700	-0.07111	±	0.1450	-1.0033	41.5992	3
Child mortality	Male	0.0325	±	0.004722	0.01249	±	0.1029	0.3840	2.1368	3
	Female	0.0372	±	0.00496	-0.1353	±	0.09044	-3.6359	10.5903	3
Post-Natal mortality	Male	0.1666	±	0.01114	0.4665	±	0.2628	2.8003	16.9354	3
	Female	0.1108	±	0.0088	-0.2179	±	0.1747	-1.9665	8.1867	3

4B.2.4 PREDICTION OF MORTALITY PARAMETERS WITH SOCIO-ECONOMIC, DEMOGRAPHIC AND BIOLOGICAL VARIABLES

4B.2.4.1 Foetal loss:

Multiple regression (step-wise) analysis was carried out to explain the influence of individual independent variables on the foetal loss, and also to assess the combined effect of several factors. The summary of each step of the multiple regression analysis is given in table-54. In this analysis number of foetal losses have been taken as dependent variable and the socio-economic, demographic and biological variables have been considered as independent variables, the results indicated that these independent variables had different implications in Pattapu and Palle caste groups. Pregnancies coefficient of Pattapu (0.739) and Palle (0.357) were positive and significant at 1 per cent probability level. These values indicate that foetal loss increases by 0.739 units in Pattapu and 0.357 units in Palle for every unit increase in pregnancies. In Palle live births, duration of effective married life and marriage type coefficients were negative and significant at 1 per cent probability level, but in case of Pattapu only live births coefficient was negative and significant at 1 per cent probability level. These negative values indicate that foetal

TABLE-54

STEP-WISE REGRESSION OF FOETAL LOSS

Independent variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:						
Pregnancies	.73859	.01810	40.7960**	.109	.7273	0.7172
Live births	-.72650	.01801	40.3369**	-.001		0.0065
Duration of effective married life	-.00906	.00545	1.6618	.031		0.0016
Age at puberty	-.00993	.00786	1.2626	-.022		0.0006
Income	.00988	.00787	1.2557	-.015		0.0004
Martial distance	-.00168	.00265	0.6345	-.040		0.0005
Marriage type	-.00136	.00247	0.5489	-.043		0.0005
Women age at marriage	-.00078	.00351	0.2211	-.009		0.00004
Palle:						
Pregnancies	.35713	.02182	16.3657**	0.190	.3572	0.2387
Live births	-.30347	.01897	15.9987**	0.036		0.0757
Duration of effective married life	-.05142	.01233	4.1712**	0.135		0.0232
Marriage type	-.01566	.00559	2.8018**	-.114		0.0106
Marital distance	-.00738	.00607	1.2159	-.041		0.0018
Income	-.01430	.01811	0.7892	.074		0.0021
Family planning	-.00342	.02413	0.1418	-.018		0.00019

** Significant at 1 per cent probability level

loss decreases for every unit increase in respective independent variable. The coefficients of all the remaining independent variables were negative and insignificant in both caste groups except the independent variable of income in Pattapu, where coefficient was positive and insignificant, so these independent variables did not show any significant effect on foetal loss. However, all independent variables had explained 72.73 per cent and 35.72 per cent of variation in foetal loss of Pattapu and Palle respectively. Out of these, only pregnancies was found to be the most prominent predictor, individually contributing 71.72 per cent in Pattapu and 23.87 per cent in Palle of the total variance. In Palle, next important variable was the live births which contribute 7.57 per cent of the total variance. Also 2.82 per cent of the total variance was contributed by duration of effective married life. However, all independent variables had explained 72.73 per cent variation in Pattapu which is greater than 35.72 per cent variation in Palle in foetal loss. Remaining independent variables in both caste groups showed low variation of foetal loss.

4B.2.4.2 Infant mortality:

Multiple regression (step-wise) analysis carried out to explain the influence of independent variables on the

infant mortality and also to assess the combined effect of several factors. The summary of each step-wise multiple regression analysis is given in table-55. In this analysis, infant mortality is taken as dependent variable and all the socio-economic, demographic and biological variables have been considered as independent variables. These independent variables were entered one after another according to their tolerance value. The sequence of the independent variables were presented in same order as disclosed in the computer output.

The results indicated that these independent variables had different implications in Pattapu and Palle caste groups. The coefficient 0.378 units for every unit increase in live births and it was significant at 1 per cent probability level. In case of Palle, coefficient of pregnancies 0.250 indicated that infant mortality increased by 0.250 units for every unit increase in pregnancies and it was significant at 1 per cent probability level. In the second step the family planning (-0.224) and women age at marriage (-0.081) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values indicated that infant mortality decreases for every unit increased in family planning (from Vasectomy to Tubectomy) of Pattapu and women age at marriage

TABLE-55

STEP-WISE REGRESSION OF INFANT MORTALITY

Independent variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:						
Live births	.37819	.09436	4.0078**	.583	.3796	0.1399
Family planning	-.22434	.04811	4.6631**	-.127		0.0187
Duration of effective married life	-.08694	.02868	3.0314**	.359		0.0497
Income	-.08365	.04123	2.0287**	.076		0.0050
Marriage type	-.02476	.01262	1.9616*	-.048		0.0030
Age at puberty	-.07473	.04120	1.8138	-.046		0.0027
Pregnancies	-.10846	.09484	1.1437	.573		0.1597
Women age at marriage	.01524	.01836	0.8304	.033		0.0009
Palle:						
Pregnancies	.25011	.06275	3.9856**	.552	.3440	0.2472
Women age at marriage	-.08056	.01839	4.3797**	-.030		0.0050
Family planning	-.15290	.06940	2.2032*	-.103		0.0081
Duration of effective married life	-.06241	.03640	1.7144	.367		0.0328
Marital distance	.03306	.01756	1.8793	.045		0.0031
Marriage type	-.02902	.01610	1.8023	-.050		0.0033
Income	-.07525	.05209	1.4444	.089		0.0047
Age at puberty	.04325	.05508	0.7852	.000		0.0000
Live births	.03065	.05511	0.5561	.532		0.0398

* Significant at 5 per cent probability level ** Significant at 1 percent probability level

in Palle. These were significant at 1 per cent probability level. In the third step, the duration of effective married life (-0.087) and Family Planning (-0.153) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values explained that infant mortality decreases for every unit increased in duration of effective married (5 years) life of Pattapu and family planning (from Vasectomy to Tubectomy) of Palle. These were significant at 1 per cent and 5 per cent probability level in Pattapu and Palle respectively. In Pattapu caste group, fourth and fifth steps the income (-0.084) and degree of consanguinity (-0.025) were entered respectively in regression analysis. Their negative coefficient values explained that infant mortality decrease for every unit increased in income (Rs.4800) and degree of consanguinity. These were significant at 5 per cent probability level. In Pattapu from six to eight and in Palle from fourth to ninth steps showed insignificant values. However, all the independent variables together had explained 37.96 per cent and 34.40 per cent of variation in infant mortality of Pattapu and Palle respectively. Out of these, only pregnancies of Pattapu and Palle was found to be the most prominent predictors, individually contributing 15.97 per cent in Pattapu and 24.72 per cent in Palle of the total variance. Next important variable, live

births in Pattapu and Palle were contributed 13.99 per cent and 3.98 per cent to total variance respectively. Also duration of effective married life contributed 4.97 per cent 3.28 per cent of total variance in Pattapu and Palle respectively. Remaining variables showed negligible variations of infant mortality in both caste groups.

4B.2.4.3 Child mortality:

To examine the influence of individual independent variables on the experience of child mortality, and also to assess the combined effect of their factors, a step-wise multiple regression was done. The results are summarised in table-56 which indicated that independent variable had different implications in Pattapu and Palle caste groups. Here, child mortality has been taken as dependent variable and the socio-economic, demographic and biological variables have been considered as independent variables.

Coefficient of pregnancies in Pattapu (0.170) and Palle (0.085) were positive and significant at 5 per cent probability level. These values indicate that child mortality increases by 0.170 units in Pattapu and 0.085 units in Palle for every unit increase in pregnancies. In the second step

TABLE-56

STEP WISE REGRESSION OF CHILD MORTALITY(1-14 years)

	Independent variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:	Pregnancies	.17026	.07198	2.3656*	..460	.2261	0.1240
	Income	-.07044	.03129	2.2511*	.023		0.0019
	Family Planning	-.07464	.03657	2.0410*	-.069		0.0050
	Women age at marriage	-.01331	.01396	0.9538	-.020		0.0007
	Live births	-.04766	.07162	0.6655	.453		0.0820
	Marriage type	.00525	.00984	0.5332	.029		0.0056
	Duration of effective married life	.00850	.02177	0.3905	.348		0.0069
	Marital distance	.00301	.01056	0.2851	.001		0.00001
	Age at puberty	.00853	.03128	0.2726	.000		0.0000
Palle:	Pregnancies	.08497	.03561	2.3861*	.392	.1769	0.1435
	Income	-.06296	.02956	2.1298*	.016		0.0014
	Women age marriage	-.02096	.01044	2.0082*	-.005		0.0004
	Family Planning	-.06659	.03938	1.6908	-.083		0.0056
	Marital distance	-.01384	.00996	1.3887	-.053		0.0030
	Age at puberty	.02960	.03125	0.09470	.030		0.0011
	Marriage type	.00438	.00914	0.4791	.009		0.0018
	Live births	.00949	.03127	0.3035	.379		0.0173
	Duration of effective married life	-.00348	.02066	0.1682	.282		0.0028

* Significant at 5 per cent probability level

the income was entered in regression analysis of Pattapu (-0.070) and Palle (-0.063). Their negative coefficient values indicated that child mortality decreases for every unit (Rs.4800) increased in income of both caste groups. These were significant at 5 per cent probability level. In the third step, Family Planning (-0.075) and womens age at marriage (-0.021) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values explained that child mortality decreases for every unit increased in family planning (from Vasectomy to Tubectomy) of Pattapu and women's age at marriage of Palle. These were significant at 5 per cent probability level. From fourth to ninth step in both caste groups did not show the significant values. So these independent variables did not show any significant effect on child mortality. However, all independent variables together had explained 22.61 per cent and 17.69 per cent of variation in child mortality of Pattapu and Palle respectively. Out of these, only pregnancies was found to be most prominent predictors, individually contributing 12.40 per cent in Pattapu and 14.35 per cent in Palle of the total variance, Next important variable, live births in Pattapu and Palle contributed 8.20 per cent and 1.73 per cent to total variance respectively. Remaining variables showed negligible variation of child mortality in both caste groups.

4B.2.4.4. Post-natal mortality

Socio-economic, demographic and biological factors were considered as independent variables to explain the variance in post-natal mortality and to estimate what amount of variance could be explained with the help of several factors. The step-wise regression analysis was carried out and the result at each step and the summary of result at the last step are presented in table 57. It could be observed from the table that these independent variables had different implications in Pattapu and Palle caste groups. The coefficient 0.331 in Pattapu indicated that Post-natal mortality increased by 0.331 units for every unit increase in live births and it was significant at 1 per cent probability level. In case of Palle, coefficient of pregnancies indicated that Post-natal mortality increased by 0.331 units for every unit increase in pregnancies and it was significant at 1 per cent probability level. In the second step, the Family Planning (-0.299) and womens age at marriage (-0.106) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values indicated that Post-natal mortality decreased for every unit increased in family planning (from Vasectomy to Tebectomy) of Pattapu and womens age at marriage in Palle. These were

TABLE-57

STEP-WISE REGRESSION OF POST-NATAL MORTALITY

	Independent Variable	Coefficient	S.E.	t-value	r	R^2	% individual contribution of variable
Pattapu:	Live births	.33056	.10136	3.2612**	.711	.5435	0.3747
	Family Planning	-.29920	.05170	5.7873**	-.139		0.0219
	Income	-.15423	.04426	3.4845**	.073		0.0071
	Duration of effective married life	-.07862	.03076	2.5554*	.475		0.0475
	Age at puberty	-.06515	.04292	1.2179	-.036		0.0015
	Marriage type	-.01944	.01393	1.3960	-.023		0.0009
	Pregnancies	.06187	.10187	0.6074	.707		0.0898
	Marital distance	.00297	.01491	0.1987	-.016		0.0001
Palle:	Pregnancies	.33078	.07153	4.6245**	.619	.4286	0.3161
	Women age at marriage	-.10612	.02097	5.0611**	-.034		0.0061
	Family Planning	-.21360	.07911	2.7001**	-.117		0.0105
	Income	-.13249	.05938	2.2312**	.084		0.0064
	Duration of effective married life	-.06287	.04149	1.5154	.423		0.0312
	Marriage type	-.02943	.01835	1.6038	-.046		0.0025
	Age at puberty	.08328	.06278	1.3265	.017		0.0007
	Marital distance	.01876	.02001	0.9373	.011		0.0003
	Live births	.04595	.06282	0.7314	.597		0.0548

* Significant at 5 per cent probability level ** Significant at 1 per cent probability level

significant at 1 per cent probability level. In the third step, the income (-0.154) and family planning (-0.214) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values indicated that post-natal mortality decreases for every unit increased in income (Rs.4800) of Pattapu and family planning (from Vasectomy to tubectomy) of Palle. These were significant at 1 per cent probability level. In fourth step, the duration of effective married life (-0.079) and income (-0.132) were entered in regression analysis of Pattapu and Palle respectively. Their negative coefficient values indicated that post-natal mortality decreases for every unit increased in duration of effective married life (5 years) of Pattapu and income (Rs.4800) of Palle. These were significant at 5 per cent probability level. In the remaining independent variables, some variables showed negative coefficient values and some variables showed positive coefficient values and insignificant in both caste groups. So, these independent variables have not showed significant effect on post-natal mortality. However, all independent variables together had explained 54.35 per cent and 42.86 per cent of variation in post-natal mortality of Pattapu and Palle respectively. Out of these, only live births of Pattapu and pregnancies of Palle were found to be the most prominent predictors, indi-

vidually contributing 37.47 per cent (live births) in Pattapu and 31.61 per cent (pregnancies) in Palle of the total variance. Next important variable, pregnancies in Pattapu and live births in Palle have contributed 8.98 per cent and 5.48 per cent to total variance respectively. And also duration of effective married life contributed 4.75 per cent and 3.12 per cent of total variance in Pattapu and Palle respectively. Remaining independent variables showed negligible variation of post-natal mortality in both caste groups.

4B.2.5 SELECTION INTENSITY

The opportunity for natural selection according to Crow (1958), Johnston and Kensinger (1971) and Hed (1984) are computed for the menopause attained mothers, for the family planning adopters and of the total are presented in Table 58 to 61. The average number of live births and its variance per women attained menopause are 6.29 and 7.84 for Pattapu where as in Palle 6.19 and 6.18 respectively.

In case of family planning adopters, the average number of live births and its variance are 4.10 and 1.73 for Pattapu 3.83 and 2.11 for Palle respectively. In total the average number of live births and its variance are 5.42 and 6.56 for

TABLE 58

INDEX OF OPPORTUNITY FOR SELECTION

	Pattapu	Palle
No. of women completed menopause	203	188
No. of childless women who are completed their menopause	7	3
No. of pregnancies	1283	1186
*No. of Live Births	1276	1163
Mean of Live Births ($\bar{X}$)	6.2857	6.1862
Mean of Live Births ($\bar{X}_{sf}$) of child bearing women	6.5102	6.2865
Variance of Live Births (Vf)	7.8396	6.1834
Variance of Live Births among child-bearing women (V_{sf})	6.6581	5.6531
No. of survivors to reproductive age	931	838
No. of embryonic deaths	14	28
No. of premature deaths	345	325
Proportion of childless women (Pso)	0.0345	0.0160
Proportion of women with children (Psf)	0.9655	0.9840
Proportion of survivors to reproductive age (Ps)	0.7296	0.7206
Proportion of premature deaths (Pd)	0.2704	0.2794
Proportion of embryonic deaths (Ped)	0.0109	0.0236
Proportion of survivors to births (Pb)	0.9945	0.9806
Index of selection due to prenatal mortality (Ime = Ped/Pb)	0.0110	0.0241
Index of selection due to child mortality (Imc = Im = Pd/Ps)	0.3706	0.3878
Index of selection due to fertility ($If = Vf/\bar{X}^2$)	0.1984	0.1616
The contribution to the fertility component by childless women ($Is_o = Pso/Psf \times 1/Ps$)	0.0489	0.0225
The contribution to the fertility component by childbearing women ($Isf = Vsf/\bar{X}_{sf} \times 1/Ps \times 1/Psf$)	0.2230	0.2017

* 7 twins included in Pattapu

* 5 twins included in Palle

TABLE 59

INDEX OF OPPORTUNITY FOR SELECTION

	Pattapu	Palle
No. of family planning adopters	134	104
No. of pregnancies	553	407
*No. of Live Births	549	398
Mean of Live Births ($\overline{X}$)	4.0970	3.827
Mean of Live Births ($\overline{X}_{sf}$) of childbearing women	4.0970	3.827
Variance of Live Births (V_f)	1.7294	2.105
Variance of Live Births among child-bearing women (V_{sf})	1.7294	2.105
No. of survivors to reproductive age	475	339
No. of embryonic deaths	8	9
**No. of premature deaths	74	59
Proportion of childless women (Pso)	-	-
Proportion of women with children (Psf)	1.0000	1.0000
Proportion of survivors to reproductive age (Ps)	0.8652	0.8519
Proportion of premature deaths (Pd)	0.1348	0.1482
Proportion of embryonic deaths (Ped)	0.0145	0.0221
Proportion of survivors to births (Pb)	0.9928	0.9779
Index of selection due to prenatal mortality (Ime = Ped/Pb)	0.0146	0.0226
Index of selection due to child mortality (Imc = Im = Pd/Ps)	0.1558	0.1740
Index of selection due to fertility ($If = Vf/\overline{X}^2$)	0.1030	0.1437
The contribution to the fertility component by childless women (Iso = Pso/Psf x 1/Ps)	0.0000	0.0000
The contribution to the fertility component by childbearing women ($Isf = Vsf/\overline{X}^2sf \times 1/Ps \times 1/Psf$)	0.0891	0.1687

*4 twins included in Pattapu

**Accidental deaths are not included

TABLE 60

INDEX OF OPPORTUNITY FOR SELECTION

	Pattapu	Palle
No. of women completed Menopause family planning adopters	337	292
No. of childless women	7	3
No. of pregnancies	1836	1593
*No. of Live Births	1825	1561
Mean of Live Births ($\bar{X}$)	5.4154	5.3459
Mean of Live Births ($\bar{X}sf$) of child bearing women	5.5303	5.4014
Variance of Live Births (Vf)	6.5577	6.0071
Variance of Live Births among childbearing women (Vsf)	6.0612	5.7695
No. of survivors to reproductive age	1406	1177
No. of embryonic deaths	22	37
**No. of premature deaths	419	384
Proportion of childless women (Pso)	0.0208	0.0103
Proportion of women with children (Psf)	0.9792	0.9897
Proportion of survivors to reproductive age (Ps)	0.7704	0.7540
Proportion of premature deaths (Pd)	0.2296	0.2460
Proportion of embryonic deaths (Ped)	0.0120	0.0232
Proportion of survivors to birth (Pb)	0.9940	0.9799
Index of selection due to prenatal mortality ($Ime = Ped/Pb$)	0.0121	0.0237
Index of selection due to child mortality ($Imc = Im = Pd/Ps$)	0.2980	0.3263
Index of selection due to fertility ($If = Vf/\bar{X}^2$)	0.2236	0.2102
The contribution to the fertility component by childless women ($Iso = Pso/Psf \times 1/Ps$)	0.0275	0.0138
The contribution to the fertility component by childbearing women ($Isf = Vsf/\bar{X}sf^2 \times 1/Ps \times 1/Psf$)	0.2628	0.2650

*5 twins included in Palle

*11 twins included in Pattapu

**Accidental deaths are not included

TABLE 61

INDEX OF OPPORTUNITY OF SELECTION ACCORDING TO CROWS, JOHNSTON & KINSINGER AND HED

Population		Crow, 1958			Johnston & Kensinger, 71				Hed, 1984			
		Im (Pd/Ps)	If $(Vf/\bar{X}^2)$	I (Im+If/Ps)	Ime	Imc	If	I	Im	Iso	Isf	I
Pattapu	Menopause completed women	0.3706	0.1984	0.6440	0.0110	0.3706	0.1984	0.6570	0.3706	0.0489	0.2230	0.6425
	F.P.Ado-pted.	0.1558	0.1030	0.2766	0.0146	0.1558	0.1030	0.2923	0.1558	-	0.0891	0.2449
	Total	0.2980	0.2236	0.5903	0.0121	0.2980	0.2236	0.6042	0.2980	0.0275	0.2628	0.5883
Palle	Menopause completed women	0.3878	0.1616	0.61651	0.0241	0.3878	0.1616	0.6483	0.3878	0.0225	0.2017	0.6120
	F.P.Adopted	0.1740	0.1437	0.3466	0.0226	0.1740	0.1437	0.3731	0.1740	-	0.1687	0.3427
	Total	0.3263	0.2102	0.6107	0.0237	0.3263	0.2102	0.6411	0.3263	0.0138	0.2650	0.6051

Pattapu 5.35 and 6.01 for Palle respectively. The total number of live births to menopause attained women, family planning adopters and total are 1276, 549 and 1825 in Pattapu and 1163, 398 and 1561 in Palle respectively. The embryonic deaths and premature deaths are 14 and 345 in Pattapu, 28 and 325 in Palle for menopause completed women respectively; for family planning adopters 8 and 74 Pattapu, 9 and 59 in palle respectively. Totally 22 and 419 for Pattapu 37 and 384 for Palle respectively. From these results, the mortality (Im) and fertility (If) components of selection Intensity are found to be 0.371 and 0.198 for menopause attained women; 0.156 and 0.103 for family planning adopters, and 0.298 and 0.224 for total respectively in Pattapu; where as in Palle mortality (Im) and fertility (If) components are 0.388 and 0.162 for menopause completed women, 0.174 and 0.144 for family planning adopters, and 0.326 and 0.210 for total respectively. These components give the crow's index of selection intensity for menopause attained women (Pattapu: 0.644; Palle: 0.617), family planning adopters (Pattapu: 0.277; Palle: 0.347) and total (Pattapu: 0.590; Palle: 0.611).

The fertility and mortality components are higher in the menopause attained women than that in family planning adopters. But these differences are more in mortality com-

ponent than in fertility components. The index of mortality is higher than that of fertility indicating the selection is operating mainly due to mortality component as it has been observed in some studies among tribal population of India Narahari; 1982; Ramachandra Reddy, 1984; Deep Kumar, 1985; Ramesh and Murthy, 1985).

The value of total selection intensity index (I) has been estimated using the index proposed by crow (1958) with modification suggested by Johnston and Kensinger (1971) and with further modified (Hed, 1984) methods, show a slight disparity which is due to the contribution of prenatal mortality component (Johnston and Kehsinger 1971) and contribution of childless women (Hed, 1984) to 'I' as observed in both Pattapu and Palle caste groups.

While comparing these results with other Andhra Pradesh data, it is noticed that the index has been calculated on a variety of data, the validity of which is questionable (Chengal Reddy and Lakshmanudu, 1979). Hence, the selection intensity among Pattapu and Palle in comparison is limited to those other caste groups of Andhra Pradesh studied earlier, given in the table 62, indicate the role of selection potential through differential fertility and mortality. The index value of Jalary (1.08) is the highest among the Andhra populations

TABLE 62

INDICES OF SELECTION POTENTIAL AMONG THE CASTES OF ANDHRA PRADESH

Population	Selection Potential			Source
	Im	If	I	
Balija	0.20	0.26	0.63	Gunasundaramma, 1980
Palli Reddi	0.34	0.19	0.73	Subhashini, 1981
Vadde-I	0.03	0.76	0.58	Mukherjee, 1974
Vadde-II	0.07	0.34	0.33	Mukherjee, 1974
Vada Balija-I	0.34	0.21	0.63	Mohan Reddy, 1983
Vada Balija - II	0.54	0.20	0.85	Mohan Reddy, 1983
Jalary Reddy	0.74	0.20	1.08	Mohan Reddy, 1983
Jale Jalukdor	0.18	0.38	0.63	Mohan Reddy, 1983
PATTAPU	0.37	0.20	0.64	Present study
PALLE	0.39	0.16	0.62	Present study
Palle	0.44	0.35	0.94	Mohan Reddy, 1983
Vadde-III	0.35	0.25	0.69	Mohan Reddy, 1983
Dhobis	0.20	0.21	0.61	Subhashini, 1986
Madigas-II	0.52	0.41	0.95	Rajasekhar Reddy, 1981
Madigas-I	0.24	0.43	0.77	Chengal Reddy and Lakshmanudu, 1979
Mala-I	0.01	0.21	0.24	Mukherjee, 1974
Mala-II	0.22	0.29	0.58	Chengal Reddy and Lakshmanudu, 1979

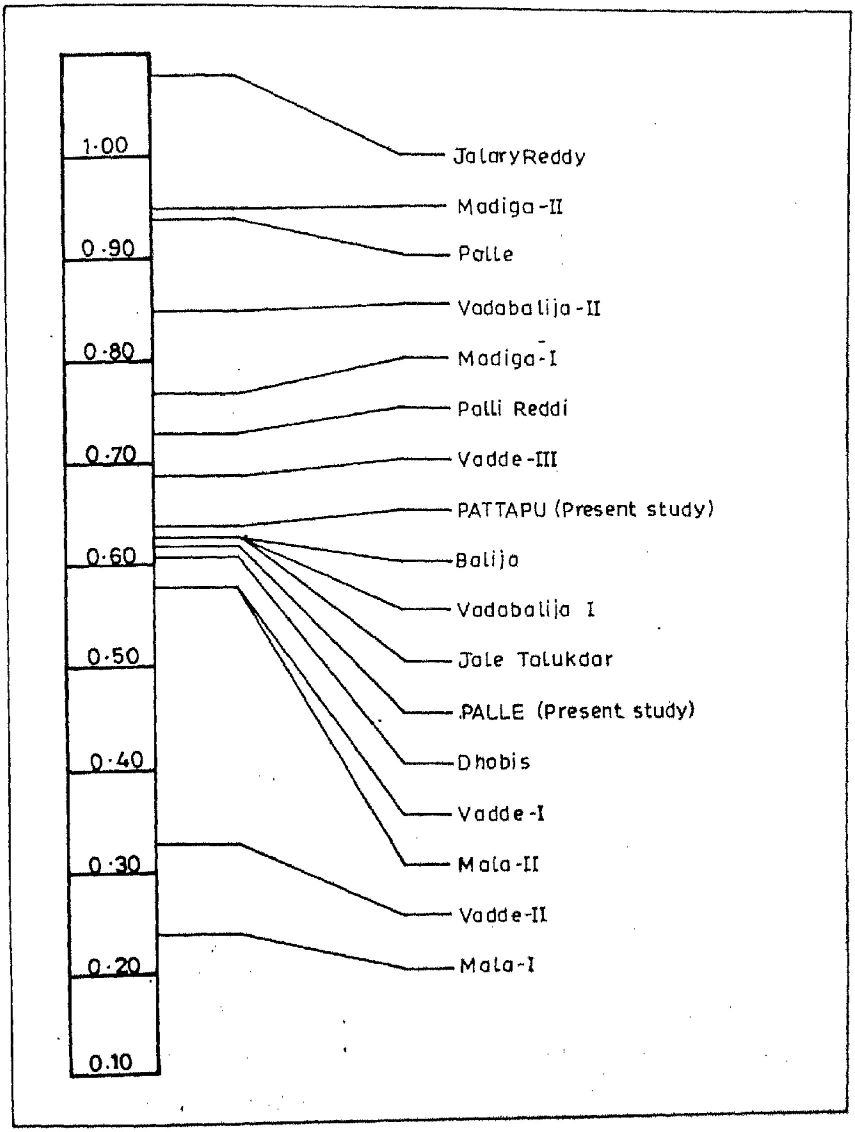


Fig.17: Gradient of Selection Intensity in Castes of Andhra Pradesh

studied so far. Mortality component vary from 0.01 (Mala-I) to 0.74 (Jalary). The mortality component (I_m) exceeds the fertility component over two times in populations such as vada Balija II, Jalary and Palle caste groups. Thus, declining trend of fertility component (I_f) is perceived in the Andhra Pradesh data, reveals that selection is operating with moderate intensity through differential mortality.

4B.2.6 BREEDING SIZE, EFFECTIVE POPULATION SIZE

The breeding size, effective population size and variance due to random genetic drift estimated for both caste groups are given in Table 63. The breeding size is smaller to that of their actual (sample) population size. It accounts for about 37% in Pattapu and about 40% in Palle of their total population. These values, however, are slightly higher than the rough estimate, usually obtained from the census figures of human populations (Freire Maia, 1974).

The mean number of living children is 4.01 in Pattapu and 3.98 in Palle with the values of variance 7.72 and 7.83 respectively. In both caste groups, the variance is greater than the mean value of living children, and so the effective population sizes in Pattapu (844) and Palle (755) are lower than the breeding size. In the presence of related individuals

TABLE 63

BREEDING SIZE, EFFECTIVE POPULATION SIZE AND VARIANCE DUE TO RANDOM GENETIC DRIFT

Population	Total Population	Breeding size(N)		No. of children per parent		Effective Population size		Variance due to random Genetic drift
		No	%	Mean	Variance	No	%	
Pattapu	2806	1039	37.03	4.01	7.72	844.34	30.08	0.000148
Palle	2343	938	40.03	3.98	7.83	754.56	32.22	0.000166

(Salzano et al. 1967) and heritability of fertility (Nei & Murata, 1966; Cavalli-Sforza and Bodmer, 1971), the effective size tend to be smaller than breeding size. The same trend is observed in several other studies (Gunasundaramma, 1980; Narahari, 1982; Mohan Reddy, 1983; Ramachandra Reddy, 1984, Nirmalananda Reddy, 1985).

4B.2.7 THE OPPORTUNITY FOR DRIFT

Drift seems to be one of the evolutionary forces causing gene frequency changes in a small population. As evident from the earlier studies (Yellen and Harpending, 1972; Wilmsen, 1973; and Hassan, 1979) the hunting and food gathering populations were never happened to be large in size and hence study of drift in primitive populations provide a tempo of human evolution.

Wright (1940, 1943 and 1948) showed the effect of 'drift' on gene frequencies based on the product of effective size and migration rate of the population. As there appears no migration, the operation of drift on genetic diversity among the two caste groups will be solely depend upon their effective sizes. The variance due to drift in Pattapu (0.000148) is lower than in Palle (0.000166). These two low values indicate that drift will have no influence in both caste groups.

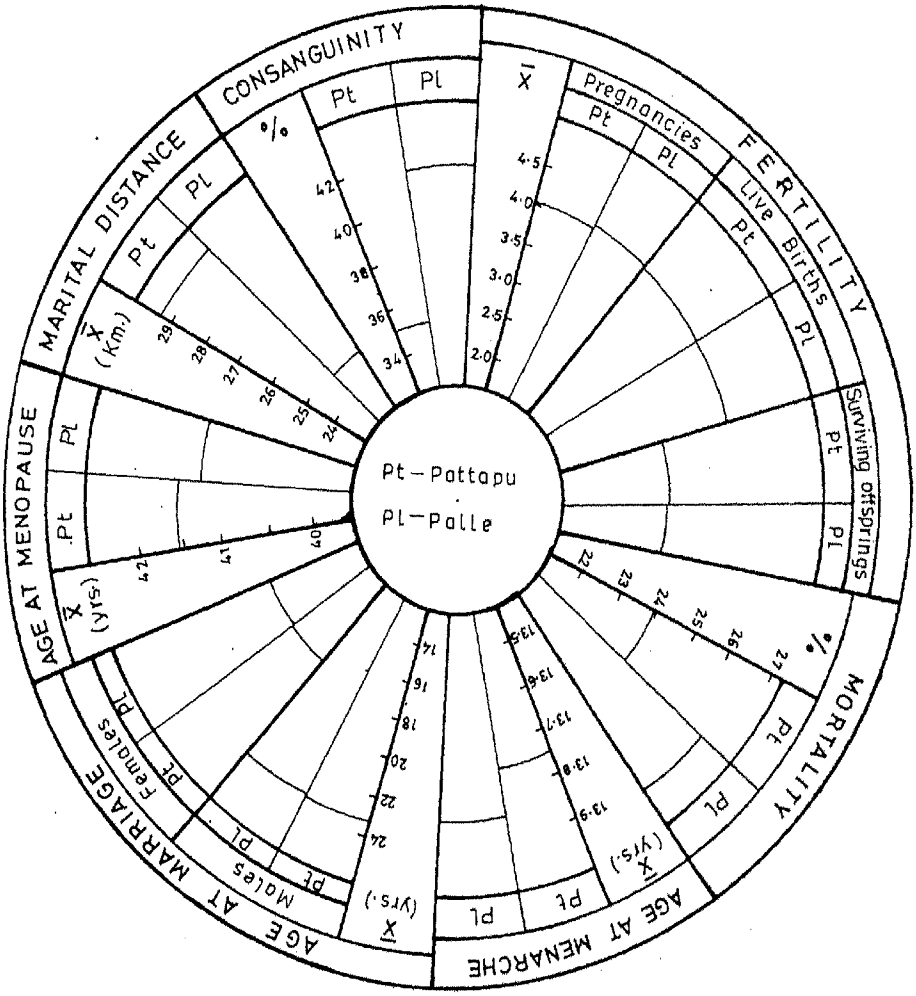


Fig. 18 : Cyclogram showing the frequency of some variables in population structure among Pattapu and Palle

CHAPTER - V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Population structure includes population size, density, age structure, patterns of migration, breeding structure, mating behaviour of individuals, effective population size and differential in fertility and mortality components which throws light on genetic process in the respective populations. These demographic parameters are used for a better comparison and to assess the ongoing evolutionary trends among the Pattapu and the Palle populations are inhabiting the same ecological zone i.e., marine fishing zone but with different origins.

Marine fishermen from Nellore district known as Pattapu and Palle were selected for the present study. The word Pattapu has been derived from the word Pattanavan. Concerning their origin Pattapu offer different stories but Palles claim themselves to be the descendents of Santhanudu and Beeshma of Maha Bharat. Both the populations speak Telugu. However, the Pattapu have their own dialect Pattapu Basha, which is a mixed language of Tamil and Telugu. Ragi is taken as a good by means of Sankati (Ragi Balls) in Palle but in Pattapu it is taken as a Java or Ambali (gruel). They are in general, medium in stature and dark or medium brown skin coloured people. They inhabit the villages exclusively by their own caste people. In the Hindu four-tier Varna system, they come under the 'sudras'. The Pattapu and Palle belong to Gobbi and Ravikula gotras respectively. The exogamous septs (Surnames) govern their matrimonial alliances. Consanguineous marriages like uncle-niece and cross-cousin types are more frequent. Nuclear family is predominant over other types of family. The family is characterised by patrilocal residence, patrilineal descent and patriarchal authority. Their traditional occupation is marine fishing. Finance is the life blood of all economic activities. Their socio-economic conditions are very poor. The caste council exist at village level in both the caste groups. They are Hindus and profess Hindu religion.

The data consisted of a sample of 1182 families, of whom 638 families were drawn from Pattapu caste and 544 families were drawn from Palle caste. Data were collected by means of an interview schedule on demographic, pedigree and socio-economic aspects. The major finding of the present study are as follows.

The age and sex composition of Pattapu and Palle in its broadest sense, reveals general tendency i.e., broad based younger age groups which more or less tapers as one moves on to older age groups - a characteristic of potentially growing population noticed in developing countires like India. But the constrictions noticed at the base of population pyramid in 0-4 years of age group suggest a recent trend of either a decline in fertility and/or high infant mortality. The recent decline in fertility in these populations may partly reflect the effect of the adoption of the family planning programme. In addition to this lack of proper medical facilities, unhygenic living conditions, prevalence of diseases, environmental and nutritionalproblems could be presumed as the reasons for the high infant mortality. No definite trend is discerned in sex ratio due to distortion in each and every age-group by 5 years age. However, there are more males than females in many age-groups of Palle but in Pattapu half of the age-groups show more females (5-9 to 25-29, 45-49 to 55-59 and 65-69 years

age-groups), while the remaining age-groups show male domination. But the age-groups of 0-14 years and 15-44 years in both the communities showed male domination. This may be due to a high mortality rate among females who may, perhaps, be more susceptible to endemic diseases than males. Another factor adding to lower male death rate may be the better care both caste males receive during sickness as well as in good health. In the Palle excess of males in age-group of 45 years or over may be due to the high number of pregnancies which increases risk of maternal morbidity or mortality and indirectly lowers down the resistance causing more proneness to diseases, where as in Pattapu the reverse trend was observed. It is all, in all probability, due to less number of pregnancies when compared to the Palle, and it decreases the risk of maternal mortality and morbidity to certain extent.

In the marital status, more number of unmarried males, widows and more married females in lower age groups are seen indicating the universality of marriage, the possibility of early marriageable age for girls and marital stability in both the caste groups. All these situations are conducive to high fertility.

The low child women ratio of both caste groups indicates low fertility ratio which is an effect of the adoption of

family planning in the recent past. Dependent children constitute over 40 per cent of the total population. Over one half are active population (15-59 years) and about 5 per cent are aged dependents (60 years and above). The aging index is more in males than females reflecting the greater average of males in these populations which may lead to higher paternal rather than maternal age. The total dependency ratio indicates that 95 persons in Pattapu and 85 persons in Palle are economically inactive persons per 100 economically active persons in the populations relatively show that these populations incline toward the under developed countries and potentially growing populations.

The mean menarcheal age is almost similar in the Pattapu (13.75 years) and Palle (13.85 years) groups but shows a statistical difference between the two groups. Compared with other occupational groups, the present populations fall within the occupational caste range in the menarcheal age and one is led to conclude that the onset of menarche decreases with the decrease in social status and to the adoption of non-vegetarianism in low status groups.

The mean age at marriage of males in Pattapu and Palle are 23.23 years and 23.06 years, respectively. The above values are significantly higher than the values of 16.90 years

and 16.82 years as observed among females, indicate the early marriageable age for girls. The mean marriage ages of either sex of present study fall within the range of the occupational castes, and we may safely infer that age at marriage is lower in low caste people than high caste people due to illiteracy, poverty etc. among the low caste people.

The mean age difference between spouses among Pattapu and Palles are 6.34 years and 6.24 years respectively. There is no significant difference observed between the two caste groups and within the caste groups between consanguineous and non-consanguineous groups.

The mean marital distance is greater in Pattapus than in Palles due to the higher incidence of consanguinity. The non-consanguineous group of the two caste groups show higher value than the consanguineous group due to the village endogamy observed to a greater extent in consanguineous marriages. The present populations did not deviate from the other Andhra Pradesh population with regard to the general trend, where in the consanguineous couples have lower marital distance than their counter parts. However, total mean marital distance of present populations fall well within the range of the other castes in Andhra Pradesh.

The frequency of consanguineous marriages in higher in the Palle (41.73%) than in the Pattapu (35.27%). Higher frequency of first cross-cousin marriages are observed in both caste groups than other consanguineous marriage types. Among first cross-cousin marriages, matrilateral cross-cousin marriages are preferred more in both caste groups (16.77% in Pattapu and 14.15% in Palle) than patrilateral cross-cousin marriages (4.39% in Pattapu and 9.01% in Palle), a general feature found in many of the south Indian populations. However, the two caste groups show the practice of uncle-niece marriages, with 4.86% in Pattapu being less than Palle of 8.82%. The other distant type of consanguineous marriages like first cousin once removed (Pattapu : 3.92% and Palle:5.33%) and second cousin (Pattapu : 5.33% and Palle : 4.41%) occur in low frequency. The village-wise distribution of consanguineous marriages showed decreasing trend from north to South in Pattapu, but in case of Palle reverse trend observed from North to South due to the density of population increasing from North to South in Pattapu but decreasing in Palle. The average autosomal and sex linked inbreeding coefficients are 0.021 and 0.029 for Pattapu and 0.028 and 0.031 for Palle caste groups, respectively. The pattern and prevalence of consanguineous marriages and inbreeding coefficient among different villages show heterogeneity. However, consanguinity and coefficient of inbreeding values of both castes fall well within the range observed in occupational caste populations in Andhra Pradesh.

The frequency of consanguineous marriages in relation to year of marriage explains a gradual decrease in consanguinity in both caste groups which may be due to the effects of modernisation and modern transport system. This trend has been reported with reference to the populations of developed countries.

Stepwise multiple regression shows that all the independent variables together had explained low per cent i.e. 6.06 per cent and 8.85 per cent, of variation in consanguinity of Pattapu and Palle respectively. Out of these only marital distance was found to be prominent predictor for variance in consanguinity in both case groups. .

Higher the village endogamy and lower the mean marital distance are observed in the consanguineous couples than in the non-consanguineous couples, a general trend observed in South Indian population. This may be due to the kinship ties which are used in group fishing in sea and poor economic conditions, which may not favour travelling to the other villages.

The village-wise mean marital distance and village endogamy of Pattapu reveals the increasing trend in mean marital distance from north to south villages, whereas in

village endogamy concerned its trend is reverse i.e., decreasing trend it observed in both the mean marital distance and village endogamy from north to south. Due to the higher incidence of uncle-niece and father's sister's daughter marriages, expected trend i.e., decreasing trend in Mean marital distance from north to south is not found. These increasing or decreasing trends among Pattapu and Palle may give support to consanguinity increment in Palle and down fall in Pattapu from north to south.

The frequency of consanguineous marriages and coefficient of inbreeding have shown decreasing trend with increasing marital distance in both castes with few exceptions of coefficient of inbreeding in Palle caste. Regarding consanguinity significant trend is observed in both castes. The highest incidence of consanguinity in the village endogamous union substantiates the fact that it decreases as the marital distance increase.

The fertility measures such as mean number of pregnancies, live births and surviving offspring showed a positive association with duration of effective married life in both caste groups except in 30 years and above group due to an inadequate sample size. These fertility measures show a positive curvilinear relationship with income. It implies

that high income group is associated with high level of fertility due to the high income group families have capability to fulfil the requirements of large number of children.

The consanguineous marriage couples showed lower fertility than non-consanguineous married couples, which goes with the belief that inbreeding reduced Darwinian fitness. The analysis by degree of consanguinity reveals that fertility measures decrease with the decrease in the degree of consanguinity from uncle-niece to second cousin in Pattapu but in Palle increasing trend observed with an exception in first cousin once removed in both caste groups.

The lower mean values for fertility measures are observed in case of family planning adopters than menopause completed women due to the fact that they got sterilization after achieving the target of the desired number of offspring. Hence, fertility is not completed in family planning adopters.

Step-wise multiple regression shows that all the independent variables together has explained high level of variation in pregnancies (98.34 per cent in Pattapu and 94.27 per cent in Palle), live births (98.34 per cent in Pattapu and 93.2 per cent in Palle) and surviving offspring (80.03 per cent in Pattapu and 70.24 per cent in Palle). Out of all these

independent variables, only duration of effective married life was found to be prominent predictor for total variance in pregnancies in both caste groups. Whereas in live births, pregnancies it was found to be prominent predictor for total variance. But in surviving off spring, pregnancies and live births was found to be more or less major predictors for total variance. In case of live births and surviving offspring, next prominent predictor for total variance was duration of effective married life.

There is a high correlation between biological parameters i.e., mothers age at the time of delivery and birth order. Because the younger women having first birth and the higher order births take place when the mother is at the end of her reproductive period.

The prenatal and post-natal mortality measures showed high mortality rates in the extreme age i.e. younger and older age-groups or extreme parities, i.e., starting and ending birth orders. The young mother is not fully matured biologically to deliver so that the probability of pregnancy related complications are high. Moreover, young mothers may not know the proper care of the new borns. Beyond age 30, the risk of pregnancy complications apparently increases because of the increasing flexibility of the female reproductive organs.

However, there is significant difference observed between castes with regarding the pre-natal mortality rates. In post-natal mortality rate significant difference is observed between sexes in both caste groups. It is only due to the highly significant difference observed in infant mortality rates.

The prenatal mortality is higher in consanguineous marriages than in non-consanguineous marriages in both caste groups, but the difference being significant only in the Palle. No specific trend was discerned by degree of consanguinity in both caste groups. This indirectly suggests the contribution of smaller recessive lethal and semi-lethal genes before birth.

The different measures in post-natal mortality rates are found to be higher among consanguineous marriages than the non-consanguineous marriages in both castes except post-natal (1-14 years) mortality rate in Pattapu where the reverse trend has been observed. The analysis by degree of consanguinity reveals different type of Post-natal mortality measures decreases with the decrease in the consanguinity from uncle-niece to second cousin with few exceptions in both the caste groups except in neo-natal mortality rate, where specific trend could not be observed. In different Post-natal mortality rates, inbreeding enhances mortality during infancy. This result

indicate that the deletarious genes are effective in post-natal stage particularly infant stage of life.

The B/A ratio in different mortality measures are found to be below ten in both caste groups showing the genetic load is segregational, except in foetal loss in Palle, where the B/A ratio more or less equal to ten, so the genetic load is nearly mutational than segregational. When we consider the sex, in both caste groups B/A ratio of male infant mortality is greater than male child mortality indicating the male mortality decreased with increase in the age due to the better treatment of males than females. This trend is being reversed in Pattapu females. Stepwise multiple regression shows that all the independent variables together had explained high level of variation in foetal loss (72.73% of Pattapu and 35.72% of Palle), infant mortality (37.96% of Pattapu and 34.4% of Palle), child (1-14 years) mortality (22.61% of Pattapu and 17.69% of Palle), and post-natal (0-14 years) mortality (54.35% of Pattapu and 42.86% of Palle). Out of all these independent variables, only pregnancies were found to be prominent predictors for total variance in different mortality measures in both caste groups except in Palle where the live-birth is a prominent predictor for total variance in Post-natal mortality (0-14 years).

The Crow index of total selection (I) is observed to be higher in menopause attained women than family planning adopters in both caste groups. The total Index of selection intensity is falling with in the range reported for Andhra Pradesh populations. The fertility and mortality components are found to be higher in menopause completed women than in family planning adopters. The mortality components is found to be higher than fertility component among them, indicating selection is operating with moderately intensity through differential mortality.

The effective population size is lower than breeding size due to the variance is greater than the mean number of living children in both caste groups. The low drift values indicate that drift will have no influence in both the caste groups.

The present study reveals the following important points of inference:

The Pattapu and Palle populations show the characteristic feature of potentially growing population with male dominance in younger age groups of their population pyramids. The marital status of these populations evinces universality of marriage.

An increase in village endogamy and decrease in marital distance is evident in the Palle than the Pattapu due to higher incidence of consanguinity in the former group. However both the populations show homogeneity in most of the other demographic characters.

Selection operates moderately through differential mortality in both the caste groups.

Finally, it can be said that the two fishermen groups, Pattapu and Palle, visualised more or less similar trend of fragments with a slight difference of fertility and mortality components, reflecting population structure besides their common socio-cultural, economic and ecological conditions under which they are living today.

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